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Off to a Good Start

PROGRESS with the Comet, entirely in keeping with its character, continues to delight everybody and inspire comment in quite unexpected quarters. The aircraft was designed to travel much faster than any other airliner, it has appeared sooner than had been expected, and it has made remarkably rapid progress in its early flight trials. In the first two weeks, 18 flights totalling some 20 hours were made, and so satisfactory was the performance of the aircraft and its four Ghost turbojets that John Cunningham felt sufficiently confident to carry out handling trials on a range of fore-and-aft loadings, to try the stall with and without flaps, and to climb to 37,500ft—very nearly its operational height. True air-speeds of 430-450 m.p.h. have also been reached. Such highly satisfactory progress as this, achieved in such a short time, offers real promise of a British recovery in the air-transport field.

Nor are these achievements unique, for another British turbine-powered airliner, the Viscount (four Dart turboprops), built to meet a different set of requirements, has also progressed smoothly and rapidly since its first flight more than 12 months ago. It is not to be wondered that other countries are watching British developments with the keenest interest, tinged with both envy and, no doubt, some anxiety.

It would be unwise, however, to allow our gratification to carry us too far too early, for it is one thing to produce a good prototype and another (in time at least) to develop it to meet the exacting requirements of modern air transport. To-day an airliner cannot be accepted if it falls short in any one of several key qualities. In the case of the turbine-powered aircraft, fuel consumption remains the most critical consideration. In addition, it should not be forgotten that airway-control problems (notably holding procedures and traffic pattern co-ordination) are by no means solved, nor is it known how comfortable or otherwise passengers will find themselves when flying at very high speeds and altitudes.

Much is, of course, already known and much more will be learned in the next two years about high-speed, high-altitude flying. Military aircraft of several types and research machines such as the Ghost Vampire have provided some of the essential data. A flight of Mosquitoes has also had as its sole duty for many months past the investigation of high-altitude weather conditions.

Anxious as everyone is to see the Comet in service quickly, it may be that its early appearance and rapid progress will be valuable chiefly in allowing both manufacturers and operators additional time to gain experience with it before the scheduled time for entry into service. There is nothing haphazard about bringing a new airliner into use: the writing-off of the earlier aircraft after a given period, the training of crews, the opening of new services to new schedules—all these are part of a long-standing operational plan which it may not be convenient, advisable or economically sound to alter. One of the main tasks of the Comet will be to help lift our airline economics out of the red.

In this connection it may be recalled that several exceptional endurance runs by turbojets and turboprops have indicated that these units will require much less servicing than do piston engines. A. Cdre. Whittle, lecturing in Paris earlier this year, estimated that for pure jets a figure of one man-hour per power unit per 10,000 miles of flying would be representative. Man-hours for airframe servicing were also likely to be reduced, due to the virtual absence of vibration from the engines. Another most important forecast was that, when produced in equal quantities, turbojets would cost less than would piston engines of equivalent power. An interesting direct comparison of performance and operating costs may be provided by the Marathon I with four Gipsy Queens and the Marathon II with two Mambas, which recently flew for the first time and of which some details and a photograph appear on page 185.

Enterprise in the building of jet airliners is no longer, however, ours alone: for another Commonwealth country, Canada, has announced the first flight of its four-Derwent transport, the Avro C-102, to be known as the Jetliner. Canada is an ideal country for the introduction of jet passenger services in view of the great distances to be covered and the fine, clear, accurately predictable weather it enjoys.

Zero Reader

Air Experience of Sperry's New Flight Instrument : Simplified Presentation for Flying, Navigation and Landing Approach

By THE EDITOR

WORK on the instrument known as the Sperry Zero Reader has been proceeding for many months on both sides of the Atlantic, and quite shortly the "streamlined" production version of the equipment is expected to emerge. It will be the result of the combined efforts of engineers and the many pilots who have had air experience of experimental and prototype equipment; the indications are that it will be very well received by all pilots. MacArthur Field, north of New York, has been the centre of much of Sperry's experimental flying.

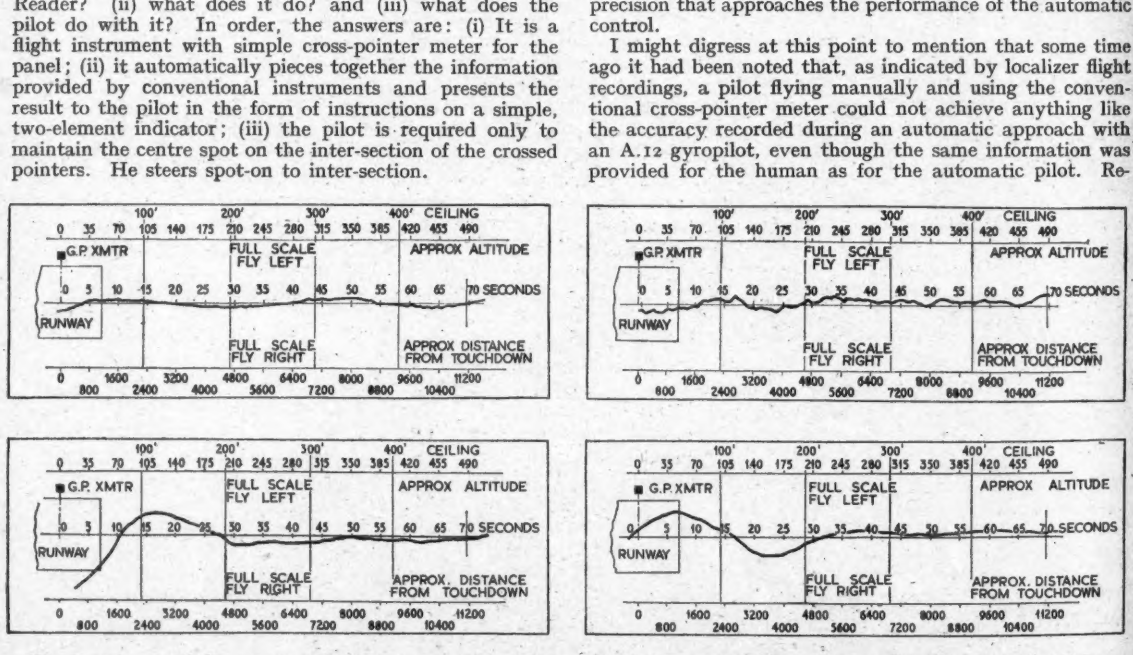
Any device which will simplify instrument flying, increase safety in bad weather and help to make traffic control at main terminals more efficient is worthy of most careful consideration. We in this country are, of course, particularly concerned with the traffic-control problems and congestion over principal airports because of the remarkable progress made with the prototypes of our jet and turboprop airliners. The introduction into service of these advanced machines is to a great extent dependent upon arrangements which can be made for accepting them without delay at their destinations in all weather conditions. The only satisfactory way for operators to assess the value of such devices as the Zero Reader, which was developed with the above aims in mind, is to try them themselves; but a description and written experiences are likely to be useful as a basis for preliminary consideration.

A week or two ago I was fortunate enough to be able to try out the Zero Reader (installed in an M.C.A. Avro XIX) both for general flying and for approach in conjunction with the London Airport I.L.S. Before describing my impressions or discussing the instrument, it might be well to give quick answers to three questions: (i) what is the Zero Reader? (ii) what does it do? and (iii) what does the pilot do with it? In order, the answers are: (i) It is a flight instrument with simple cross-pointer meter for the panel; (ii) it automatically pieces together the information provided by conventional instruments and presents the result to the pilot in the form of instructions on a simple, two-element indicator; (iii) the pilot is required only to maintain the centre spot on the inter-section of the crossed pointers. He steers spot-on to inter-section.

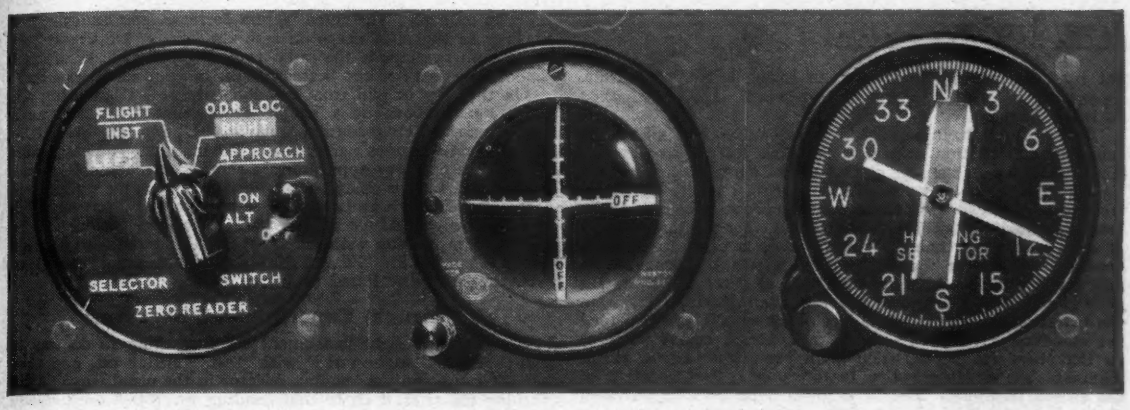
The Zero Reader is provided with its own selector switch to control the information fed to the pointers, and it must be made clear that the indication given to the pilot is not how far he may be off a pre-set course (for example) or how much above or below selected altitude or glide-path he may be, but of what change of attitude he should make in order to regain his correct course and height. Expressed differently, the instrument tells him which way to fly—not, how much he is high, low or to port or starboard. Spot-on intersection means you are "doing the right thing" even if the aircraft is making a 20 deg bank turn.

In an article in *Sperryscope*, Mr. F. Glen Nesbitt, Application Aeronautical Engineer for Sperry in America, points out that there are only two things that can be done with an aircraft in flight: you can steer right or left, and you can go up or down. Based upon this fundamental concept, the two pointers of the Zero Reader, one horizontal, one vertical, tell the pilot exactly where he should point his aircraft in order to maintain the desired altitude and direction. Mr. Nesbitt adds that for some years it has been possible to control flight automatically with the aircraft completely stabilized in smooth or rough air with the aid of the gyropilot, but it has now been established that it is not humanly possible for a man to fly an aircraft manually for extended periods under all weather conditions so well as the gyropilot can do it. It is not suggested that the Zero Reader can ever take the place of the high-performance gyropilot which is "destined to become an integral part of future high-performance aircraft," but for the first time, with the use of this instrument, the human pilot is provided with an indication which permits him to fly and navigate an aircraft manually with a degree of accuracy and precision that approaches the performance of the automatic control.

I might digress at this point to mention that some time ago it had been noted that, as indicated by localizer flight recordings, a pilot flying manually and using the conventional cross-pointer meter could not achieve anything like the accuracy recorded during an automatic approach with an A.12 gyropilot, even though the same information was provided for the human as for the automatic pilot. Re-



(Above) I.L.S. localizer recordings made during an automatic approach with A.12 gyropilot (left), and during a manual approach with Zero Reader (right). (Below) Two representative reproductions of I.L.S. localizer flight recordings taken during a manual approach using conventional instruments. Minimum ceiling authorized for use of I.L.S. by U.S. airlines at suitable airfields is 200ft.



The Zero Reader panel. (Left to right) Selector control switch, cross-pointer indicator and heading selector.

cordings taken more recently indicate that a pilot flying manually and aided by the Zero Reader is able to attain much more nearly the performance of the modern gyropilot. Various reproductions of I.L.S. localizer flight recordings are on the opposite page. The very inconsistency of consecutive recordings made in smooth air by a most proficient pilot using the conventional crossed-pointer meter gives some indication of the problem to be faced to achieve all-weather operation. What the Zero Reader was intended to, and does in fact, achieve, is the elimination of the complicated mental process required of a pilot in absorbing continuously changing indications from five separate instruments—artificial horizon, directional gyro, magnetic compass, sensitive altimeter and approach indicator—and converting the information into the requisite control movements.

According to the makers, the use of the Zero Reader by experienced pilots will permit further advances in the art of all-weather operation. An important point affecting the introduction and general acceptance of automatic approaches is that pilots have found that, should they have cause to take over manually during an automatic approach, they can, with the aid of the Zero Reader, do so quickly and confidently without any need for an overshoot or second attempt. Moreover, that period of a pilot's training which is at present necessary to enable him to learn to convert bank, pitch, compass heading, altitude and other readings into terms of control movements may be eliminated.

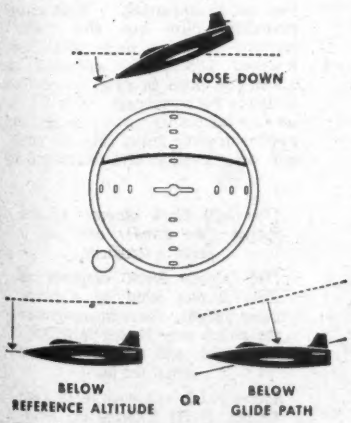
The Sperry company believes that all-weather operation must place the stabilizing gyropilot on an equal footing with the airframe and power plant if future plans for air-traffic control are to be realized. The Zero Reader remains an independent unit but supplements the gyropilot by permitting efficient manual flying. Two good reasons for the Zero Reader remaining an independent unit rather than one dependent upon the pitch, bank, altitude and compass signals from the gyropilot are that as a manual stand-by for the gyropilot it is a reserve, and should not therefore use the same source of signal information, and secondly, that the instrument may be required for installation in an aircraft that has no gyropilot.

The flight panel for the Zero Reader carries the crossed-pointer indicator, the heading selector or Gyrosyn compass (taking the place of magnetic compass and directional gyro) and the selector switch (see illustration).

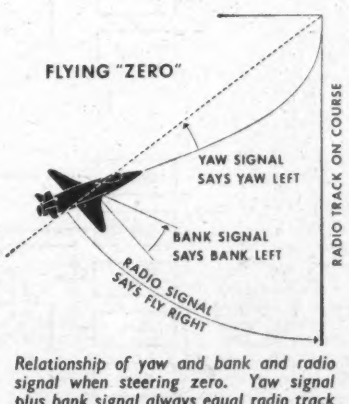
Operation of the Indicator

The crossed-pointer indicator has its two needles mutually perpendicular. Deflection of the vertical pointer is controlled by the sum of bank, stabilized heading and localizer signals. Full-scale deflection is equal to maximum localizer signal of 30-deg heading departure or 30-deg roll displacement. The sum of heading and localizer is limited so that a predetermined maximum angle of bank—20 deg when I used the instrument—will always cancel it. The horizontal pointer is controlled by the sum of pitch and altitude. Limitations are again in force to prevent the maximum pitch angle from being exceeded. "Off" flags show at 3 and 6 o'clock when the instrument is not functioning.

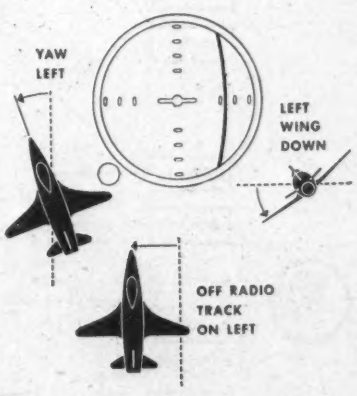
Other units, in particular the heading selector and selector switch, are described by the makers with commendable clarity as follows: "The heading selector consists of an azimuth repeater driving the pointer, and a concentric heading selector synchro, the rotor of which is fixed to the parallel-line course setter. This, in turn, is



The three conditions which will cause up and down movement of the pointer.



Relationship of yaw and bank and radio signal when steering zero. Yaw signal plus bank signal always equal radio track signal. Hunting and overshooting are avoided.



Three conditions which will cause the pointer to indicate steer right or left.

Zero Reader . . . . .

set by rotating the knob at the lower left-hand corner. Upon selecting a heading, the correct control signal is supplied to the indicator.

"The selector switch provides the pilot with a means for selecting the function he wishes the Zero Reader to perform. The two knobs on the face consist of the main control-selector knob in the centre and the altitude control knob to the right. Normally, the two switches are independent except that an interlock disconnects the altitude control when the main switch is turned to 'approach' position. This is done to avoid a confusion of signals, one calling for constant altitude flight and another calling for a constant rate of descent such as the glide slope would demand in the 'approach' position. Within the two sector cut-outs, on the face of the switch, are displayed the standard V.H.F. two-course radio range colour patterns so that they, in combination with the arrow above them, eliminate 180 deg ambiguity in interpreting the notation of the switch positions. The little green light may be provided in the bottom-left corner to indicate when altitude control is off, thus providing assurance to the pilot prior to 'take-off.'

Sources of Signals

"Of the remaining units the vertical gyro has pitch-and-roll signal pick-offs to supply the attitude repeat-back signals to the indicator; the gyrosyn compass supplies the repeat-back azimuth signals; and the altitude control, the altitude repeat-back signals. The control consists of an amplifier, signal modifier, combiner and limiter, and also includes the vertical gyro and altitude control. Signals are also obtained from the aircraft's glide slope and navigation receivers."

Conditions controlling the pointers' indications in horizontal and vertical directions are shown graphically in the small diagrams reproduced from *Sperryscope*. Regarding the control illustration of flying zero, the aircraft is shown to the left of the beam, which means it must be flown towards the right to get on course. The heading selector of the Zero Reader is set to the magnetic heading of the beam. As the aircraft is banked towards the beam the bank signal says "steer left." This cancels the "fly right" radio signal and allows the Zero Reader to be zeroed. Holding it on zero while banked, however, causes the aircraft to turn towards the beam and the yaw signal which results as measured by the compass says, like the bank signal, "steer left." As the beam gets nearer, the radio signal decreases and the sum of "bank left" and "yaw left" signals exceeds the "fly right" radio signal. The Zero Reader therefore says "steer left" and the pilot removes bank to keep on zero. The three factors decrease continuously, but so long as the pilot keeps on zero the sum of bank and yaw signals always equals the radio track signal. The result is a smooth curve on to the beam without hunting or overshoot.

On the way to and from London Airport I tried using the Zero Reader both as a simple flight instrument and as a navigation or cross-country instrument, and on arrival at Heathrow two passes were made at the main 280 runway, using I.L.S. (the not very appropriately named approach aid). Incidentally, I.L.S. is installed at only a few major airfields in Great Britain such as London, Prestwick and Filton, but is in much more general use in America. The Zero Reader can be used in conjunction with most approach and radio navigation aids, e.g., I.L.S., G.C.A., V.A.R. (visual aural range) or V.O.R. (omni-directional range).

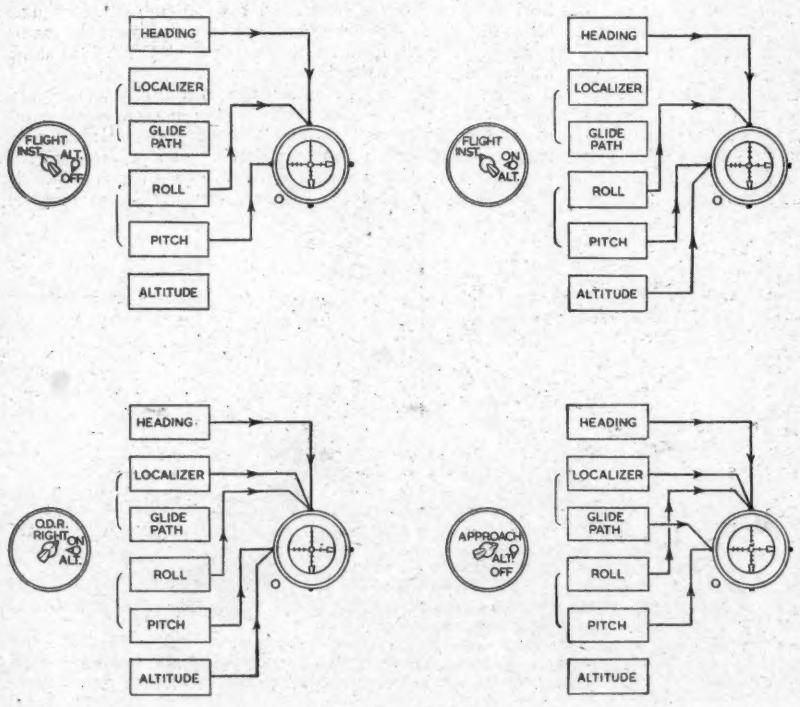
Practical Experience at Heathrow

For use as a flight instrument the first thing to do was to switch on to "flight inst." with "alt." switch off, and then set the course on the heading selector in the usual way. After turning the aircraft on to that heading we settled on a steady 500 ft/min climb attitude and set the horizontal pointer on zero with the pitch-trim knob on the indicator. So long as the course and attitude remained correct, the intersection of the pointers remained on the central "aeroplane," i.e., at zero-zero. When the intersection wandered off to, say, four o'clock, the aircraft was banked right and the nose lowered until the intersection and aeroplane coincided again. The bank had on occasions to be held on for some seconds if the aircraft was far off course, but the pointers indicated zero so long as I was doing the right thing to return to the pre-selected conditions of flight. The sensitivity of the indicator itself seemed about right. If any adjustment is to be made, I think personally it should be towards reduced sensitivity. I understand such adjustment is quite a simple matter.

On our reaching the height we wanted, the selector altitude switch was put on and the Zero Reader then became a straightforward cross-country guide for holding a steady course and altitude. It was after some ten minutes' flying that I began to appreciate the qualities of the instrument, for, without undue effort, I was able to fly with an accuracy of ±2 degrees on heading and ±20ft in altitude. Air conditions were not rough but nor were they entirely calm.

As we approached London Airport from the south-east we called up to ask for I.L.S. aid and permission to approach. Instructions were given, and we approached at about 60 deg to the runway heading to intercept the localizer beam well out from the airport at the correct approach altitude. Instruments were reset to feed the Zero Reader with our new course and altitude. On entering the beam, wheels were lowered and we watched the normal I.L.S. cross-pointer meter. The course setter was put on to the runway heading, no allowance being made for drift, and the selector switch was put on to O.D.R. Loc. (right) position.

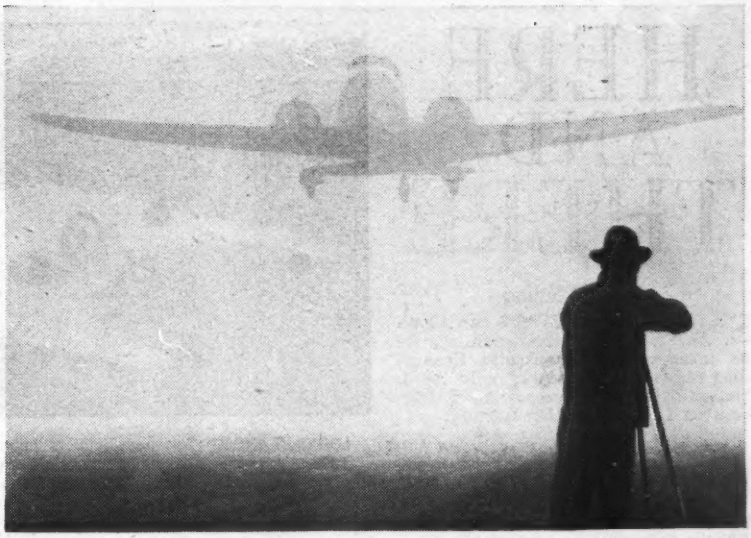
I continued to hold zero reading as well as I could, and as the I.L.S. horizontal needle registered the start of the glide-path, the Zero Reader selector switch was put on to approach. This automatically cuts out the "alt." switch. Some flap was now lowered and power adjusted to allow the nose to drop to correct attitude for approach. The I.L.S. horizontal pointer was checked for approach-path from time to time, and on occasions the difference in



(Top left) Block diagram of the Sperry Zero Reader used as a flight instrument.

(Top right) Block diagram of Zero Reader used on a cross-country flight. For radio navigation the switch may be put to O.D.R.-Loc. right and the radio beam signal fed in.

(Below) I.L.S. approach using Zero Reader: (Left) Entering the localizer beam, and (right) in the glide-path.



An unretouched photograph of one of Sperry's DC-3s engaged in Zero Reader development. Visibility was at 265ft and the ceiling was less than 50ft.

indications from the two cross-pointer dials was very marked, the I.L.S. horizontal needle indicating "high" on the glide-path and the Zero Reader counterpart saying "get down."

The remainder of the approach, which I could see was shaping a great deal better than I could possibly have made it do by ordinary blind instruments, was simply a matter of keeping the pointers on zero-zero as earlier. As the runway got nearer and nearer, the sensitivity of the beam increased, but the effect was hardly noticeable on the Zero Reader, though the same could not be said of the I.L.S. cross-pointer meter.

There was no need to consider drift, but had there been more than about 5 degrees it would simply have necessitated re-setting the heading selector.

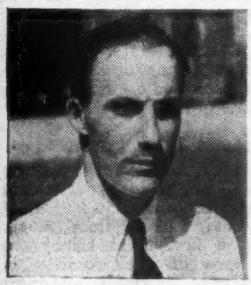
On the first attempt I was able to bring the aircraft accurately down on to the end of the runway, which is something of a testimonial for the Zero Reader, for I was strange to the procedure, the instrument and the type of aircraft.

On the short flight back to base at Gatwick my M.C.A. co-pilot directed my flying by altering heading and altitude settings while I followed with the aid of the Zero Reader. I got a little tired, due to inexperience, no doubt, and once or twice momentarily took reverse action, but the indication of this was immediate and I was able to react correctly before a heading or altitude error, even of the magnitude which one expects with normal blind flying, had occurred.

I should, perhaps, add here that the Zero Reader is an extra instrument, and cannot replace the standard blind panel wholly or in part. The standard instruments—horizon and primaries—are still needed, if only for emergencies, sudden changes of attitude or recovery from extreme attitudes. My experience with the Zero Reader left me in no doubt, however, that it offers a great advance in interpretation and simplifies the pilot's job a great deal. Most important, however, is the fact that it enables manual instrument flying to be carried out with a degree of accuracy which was previously beyond the ability of even the most experienced of pilots.

Mamba Marathon Performance

The H.P. Turboprop Feederliner on Test



"Flight" photographs.

In this first air portrait of the Marathon 2 the "humped" appearance of the Mamba nacelles is apparent. The chief test pilot of Handley Page (Reading), Ltd., Hugh Kendall (above) is in charge of the test-flying programme.

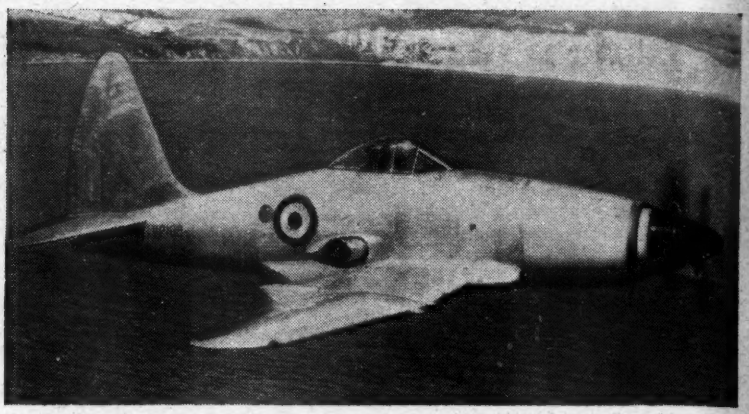
SUBJECT to prior completion of 10 hours' flying, the Mamba-powered version of the Marathon—constructed by Handley Page (Reading), Ltd.—will take part in the flying programme at the 1949 S.B.A.C. display, to be held at Farnborough in just over a fortnight's time. The first flight, lasting half an hour, was made on July 21st.

When the accompanying photograph was taken, last Friday, the machine was airborne for 97 minutes, bringing its flying time well past the four-hour mark. Initial handling trials have been satisfactory—Hugh Kendall's confidence in taking the Marathon, on half power, so close to the photographic Anson gives adequate proof of docility.

Extreme smoothness and near-absence of engine noise, combined with a fighter-like climb, are certain to command attention at the display. Flying "light" (at about 13,000 lb all-up weight) during last week's demonstration, the Mamba Marathon left the grass surface of Woodley airfield after a run of about 300 yd, to the accompaniment of a quiet drone from the Mambas. Likewise unloaded, it showed a rate of climb approaching 3,000ft/min. On one turboprop alone it pulled out and zoomed impressively from a low-level flypast.

Full performance data are not yet available, but, in service trim, at 18,000 lb "all-up," maximum range of this 20-seat experimental feederliner is expected to be 900 miles. About 140 gallons of extra fuel are carried in place of the two outboard engines of the standard Gipsy-Queen-powered version. Cruising speed should be about 260 m.p.h., and quoted rates of climb are 2,100ft/min on both Mambas—600ft/min on one.

HERE AND THERE



LOOKING AHEAD: This manufacturers' impression of the Python-powered Westland Wyvern T.F.2 torpedo-fighter in service reveals a new configuration for the fin and rudder, seen to be considerably taller. There appears to be a camera-port aft of the roundel.

In Full Swing

SILVER CITY AIRWAYS carried on August 5th the thousandth car to be taken across the English Channel since the ferry service began in April. Sixteen regular trips are now flown daily between Lympne and Le Touquet.

Operation "Witch-Doctor"

UNDER the unofficial "code-name" above, the R.A.F., in conjunction with I.C.I., Ltd., have recently conducted rain-making experiments over Tees-side. A Wellington from Middleton St. George made three sorties, and on two occasions succeeded in producing rain by dropping "Drikold"—the I.C.I. trade-name for solid carbon dioxide—on suitable clouds.

SR/A.1 Accident

A PROTOTYPE Saunders-Roe SR/A.1 jet fighter flying boat—the machine retained by the company for research—turned over and sank after appearing to strike driftwood during the alighting run after a test flight. Lt. Cdr. E. M. Brown, senior Naval test pilot, who was flying the machine, escaped from the cockpit unhurt. Owing to the depth of water, it is not certain whether or not the SR/A.1 can be salvaged.

London-N.Z. Race

THE organizers of the international air race from London to Christchurch, New Zealand, to be held in 1953, and for which £30,000 in prize money is offered, state that it is hoped to announce entry conditions towards the end of this year. There will be speed and handicap sections, and it is possible that a separate airliner class will be included. The New Zealand Government has announced its approval of the event and is interested financially, and the British Ministry of Civil Aviation has signified its interest, while the de Havilland Company has already sent in an entry. The organizers (Canterbury International Air Race Council, 116, Hereford Street, Christchurch, N.Z.) are represented in this country by the race committee of the R.Ae.C.

Sweden Orders Jets

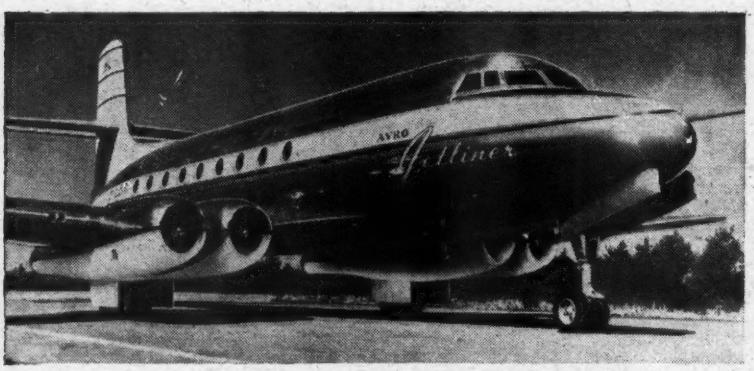
FIVE hundred Saab J-29 Ghost-powered jet fighters have been ordered by the Swedish Air Force, according to a report from Stockholm.

Fairey Rockets

NEWLY registered in Adelaide, with a nominal capital of £1,000,000, the Fairey Clyde Aviation Company is devoted entirely to long-range weapon work, under contract to the Ministry of Supply. A research organization is to be set up at Salisbury, 12 miles from Adelaide.

Death of Air Attachés

THE British Air Attaché in Ankara, A. Cdre. G. Bartholomew, and his assistant, W/C. S. N. L. Maude, D.S.O., D.F.C., were among the seven people killed when a Turkish aircraft crashed at Ankara last Sunday. W/C. L. G. Burmand, who had arrived in Turkey the previous day to replace W/C. Maude, was also killed. The party was on its way to Smyrna to meet Vampires of No. 32 Squadron from Cyprus, the visit of which is reported to have been postponed.



JETLINER: As related on this page, the Avro Canada C-102 (above) made its first flight on Wednesday of last week. It is powered by four Derwent 5s, adapted for civil use.

Quick Clipper

A RECORD Gander-London flight of 307 m.p.h. was made on August 11th by the Pan American Airways stratocruiser *Clipper America*. It was piloted by Capt. F. Jacobs, who set up a New York-London record of 9 hr 46 min in April. His latest record flight took 6 hr 48 min.

International Gas-Turbine Instruction

TO mark the assembly of the largest international course so far accepted by Power Jets (Research and Development), Ltd., an informal luncheon of welcome was held last Sunday at 25, Green Street, W.1, the Company's London premises. Thirty-two "students" representing fifteen countries are now busily engaged at Lutterworth on the intensive three-week course—one of the series held at regular intervals by this private company, one of whose main objects is to foster and encourage the use of gas turbines of all types.

Jetliner's First Flight

ON Wednesday, August 10th, the Avro Canada C-102, to be known as the Jetliner, which is powered by four Rolls-Royce Derwents, took off from Malton, Ontario, for a first flight lasting one hour. Its crew of three consisted of H. J. ("Jimmy") Orrell and Don Rogers, the chief test pilots of, respectively, the British and Canadian Avro concerns, and Bill Baker, flight engineer. They reported that the new airliner, which is designed to carry 50 passengers at 430 m.p.h. and 43,000ft, handled "easily and effortlessly." Earlier this year Don Rogers made a tour of the Hawker Siddeley Group factories in Britain to gain experience of flying jet aircraft. It included a visit to Avro Canada's parent company at Woodford, where, with Orrell, he flew the Nene-powered Tudor VII research airliner.

New Australian Trainer

TWO prototypes of a new basic trainer have been ordered by the Royal Australian Air Force. The aircraft—the first project of the Commonwealth Aircraft Corporation's post-war design staff—will be a low-wing monoplane with fixed undercarriage, powered by a single 445

HERE AND THERE

h.p. Pratt and Whitney Wasp Junior radial engine.

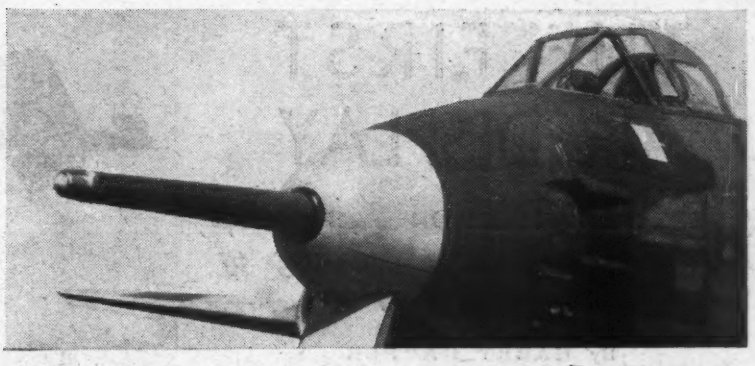
There will be side-by-side seating for instructor and pupil, and, it is reported, a third rear seat for an extra pupil. A one-sixth-scale model of the C.A.C. trainer has been sent to the Australian Research Laboratory for wind-tunnel tests. The all-up weight of the machine, which will have a wing span of 38ft 9in, is expected to be about 3,600 lb.

R.C.A.F. Base Re-activated

A TWO - AND - A - HALF - MILLION DOLLAR building programme is to be undertaken by the Royal Canadian Air Force at Bagotville to bring the station up to operational requirements. Bagotville was an active R.C.A.F. station during the war, but it has not been used as a permanent base for some years. It was announced last year that the station was being re-activated, in accordance with the post-war plans of the R.C.A.F.

The work includes the extension of the runways and an extensive building programme to provide barracks and married quarters.

U.S. PIONEER : Glenn L. Martin, seen holding a model of the Martin six-jet XB-46 bomber, recently celebrated the 40th anniversary of his first flight, made in a biplane—also seen here in model form—of his own design. On August 1st he became chairman of his company.



TOPER'S NOSE : The distinctive "probe" fitted to this Meteor 3 enables its two Derwent I turbojets to be refreshed in the air. As recorded in "Flight" last week, Mr. Pat Hornidge, of Flight Refuelling, Ltd., kept the machine airborne for 12hr. 3min. by topping-up the fuel tanks ten times from a Lancaster tanker. Connection with the hose is made automatically.

News in Brief

NEVILLE DUKE'S London-Rome-Karachi flight on May 12th in a Hawker Fury (Centaurus 18) has been confirmed by the F.A.I. as two point-to-point records at 358.88 m.p.h. for London-Rome and 256.1 m.p.h. for London-Karachi.

* * *

The S.B.A.C. states that its 1949 educational grants, for apprenticeships with leading constructors, have been awarded to R. E. Catterwell, A. D. England, N. L. Filleul, D. L. Hawkes, P. Arthur and W. E. Stanbridge. No award of the Amy Johnson Scholarship (for girls) has been made for 1949.

* * *

Helicopter Utilities, Inc., of White Plains, New York, have been appointed distributors of the Hiller 360 three-seat utility helicopter in Eastern New York State, New Jersey and the Western Connecticut area. The makers of the Hiller 360, United Helicopters, Inc., claim that it is "by far the lowest-priced helicopter marketed today."

A. C. Wickman, Ltd., Coventry, announce the appointment of Mr. C. F. Watts as the Company's secretary and of Mr. W. V. Hodgson as general manager of the machine-tool division.

* * *

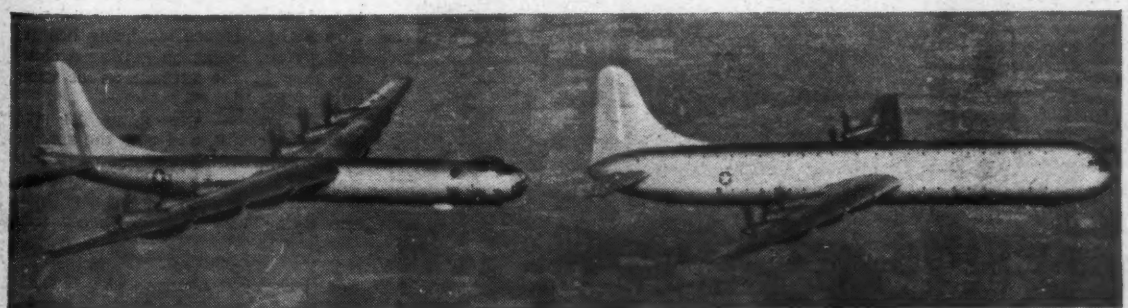
The 275ft-high pylons which carry power lines across the River Orwell at Ipswich have recently been fitted with obstruction lights which are switched on and off by G.E.C. photocell equipment actuated by the prevailing light conditions.

* * *

Flown by Northrop's chief test pilot, Max Stanley, the prototype Northrop Raider three-engined "assault transport" was airborne for the first time at Hawthorne, California, on August 1st. The flight lasted about 30 min. Twenty-three Raiders are being built for the U.S.A.F., and Canadair, Ltd., of Montreal, holds a licence to build the type for a world market.

FORTY YEARS BACK

"Few people can have any conception of how really busy Short Brothers have been this last few months since they have established themselves on this unique flying ground [Shellbeach, Isle of Sheppey], but the mere fact that they are employing about eighty men is at least proof of the fact that they take their work seriously."—*From "Flight" of August 14th, 1909.*



CORONA-CORONA : The Convair B-36 bomber (left) and XC-99 transport are the "world's largest" in their respective categories.

THE FIRST AIR DISPLAY

A Veteran Aviation Journalist Recalls the Rheims Meeting of 40 Years Ago

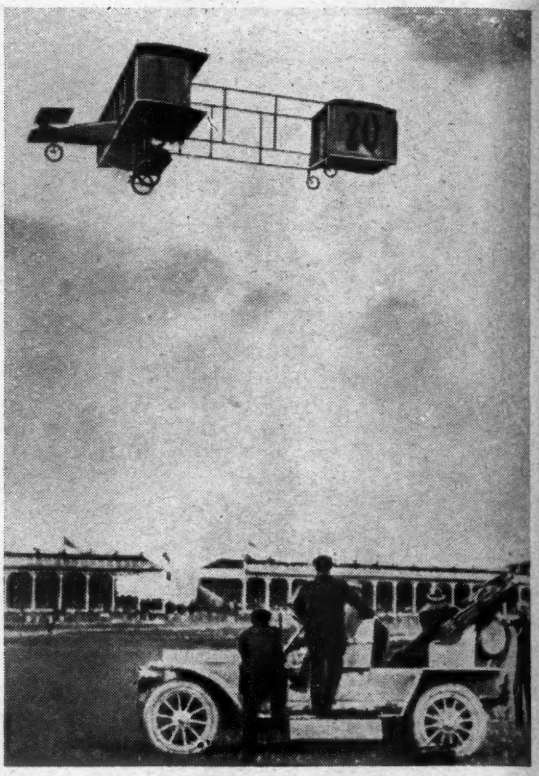
By HARRY HARPER

ON a hot summer's afternoon, in August, 1909—almost exactly 40 years ago—I was sitting in the shade below one of the pylons on the far side of the aerodrome at Rheims. The world's first flying meeting was in progress.

In the distance I could see, shimmering in the heat, the line of grandstands and sheds; and a hum reached my ears from the thousands of spectators who had gathered to see the then astonishing and dramatic sight of engine-driven, heavier-than-air craft carrying a human being in actual flight.

Out here it was oddly quiet and peaceful. I shut my eyes and was getting rather drowsy in the heat when a queer, elusive sound came across the field. It was a whizzing, whirring, buzzing sort of noise—hard to describe, but unmistakable if you happened (as I did) to know what it was. It was the noise made by the earliest revolving Gnome engine—then making its first appearance in an aeroplane before any considerable number of the general public.

That same morning Henri Farman—racing motorist and pioneer airman—had taken me into his shed to show me the Gnome which had just been fitted to the biplane he was flying at Rheims. This was the first Gnome I had seen; it was, in fact, one of the first to be installed in any aeroplane. But Henri had already made trial flights with it, and was full of praise for this—to me—odd-looking piece of specialized engineering. He told me how his friend Laurent Seguin had evolved the idea after first exploiting it in motor cycles. And he went on to explain how the crankshaft remained stationary while the seven cylinders and crank-chamber revolved round it; the carburettor, also stationary, fed the engine through the hollow crankshaft, and the mixture then filled the crank-chamber, from which each cylinder drew its supply through an inlet valve in the piston-head. It all sounded very complicated to me, and had not that engine been a beautiful piece of work constructionally—hand-made from fine materials by expert craftsmen—I do not think it would have run as well as it did on this and other occasions.

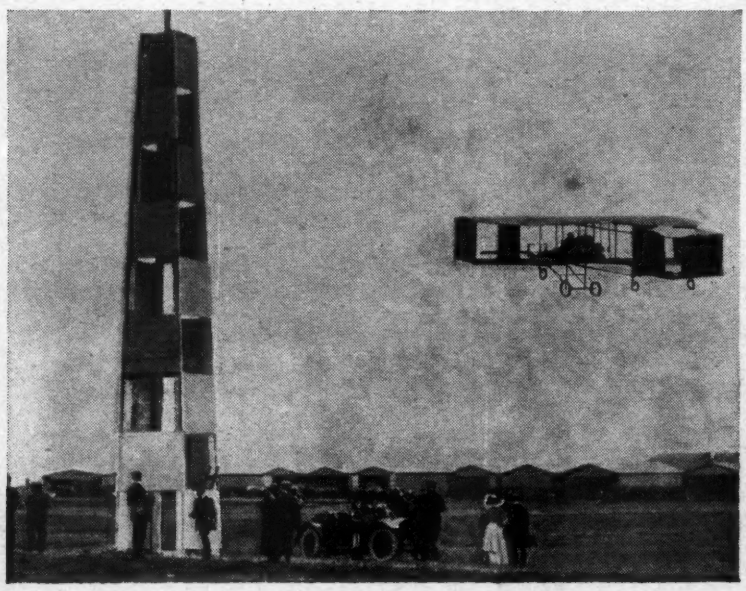


One of the big Voison biplanes flying in front of the grandstands—and over a typical car of the period. Nosewheels are not so new!

One of the advantages of the Gnome, which Henri stressed, was that it gave its 50 h.p. for a weight of only about 3.5 lb per horse-power, and as cooling was ensured by the way in which its cylinders spun round, it obviated all that "plumbing" which often proved so troublesome with early water-cooled engines.

Farman had told me he intended to come out that afternoon and try to win one of the big prizes of the meeting—that offered for the longest non-stop flight. Hence my being beneath that pylon, intent on getting a close-up view of the airman as he came circling round.

That Gnome was doing its stuff smoothly, easily, and with the absence of vibration which was one of its outstanding features. Leaning well forward in the seat of his open cockpit, and flying very low—not more than



An interesting contrast with recent pictures of the pylon-racing at Elmdon—a Voison "in full flight" (as they used to say in those days) at the Rheims meeting.

The First Air Display . . . . .

fifteen or twenty feet high—Henri came skimming up to the pylon, swinging round it so near the ground that I felt I could almost have touched his inner wing-tip. Then away he went, the sound of that Gnome dying to a sleepy hum in the distance.

And now everything became so quiet again that I began to feel more and more drowsy in the afternoon heat. And that was how it actually went on for circuit after circuit—Henri waking me up, so to speak, each time he came buzzing round. Time seemed almost to stand still as he just flew on and on, the engine continuing to function with a precision which was all the more remarkable, of course, seeing that in those days many pioneer aircraft engines could not be relied upon to run for more than a few minutes without developing trouble of one kind or another. Actually Farman was in the air for 3 hours 4 minutes, winning the valuable duration prize and, incidentally, setting the first seal of success on that famous Gnome—which was subsequently to play so big a part in early aviation history.

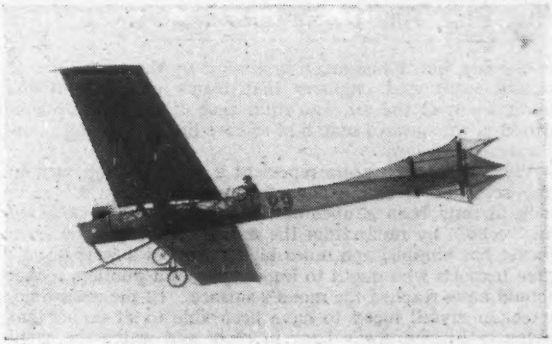
I was at my favourite post under the pylon on the afternoon when the world's first international aeroplane race was flown, and I can well remember how Glen Curtiss, the winner, came up in his neat little biplane to make his turn. He was flying all out at what then seemed the astonishing speed of between 45 and 50 miles an hour.

The Fastest Machine

Although Curtiss won—his average working out at 47 m.p.h.—actually the fastest machine was a monoplane which Bleriot had built for the occasion. In this machine he sat underneath the wing with a 60 h.p. E.N.V. motor just in front of him, driving a big airscrew through gearing. He was flying at over 50 m.p.h. when a petrol pipe broke. He had to make a hasty landing, with flames licking round the front of his machine. The monoplane was damaged badly, but Bleriot was unhurt.

One of the most exciting events was the altitude contest. This Hubert Latham won in his Antoinette. Ascending in slow, wide circles above the aerodrome, he went on climbing till he was at the—to us then—dizzy height of 500 feet. A truly remarkable performance that seemed, and I can recall the applause which was coming from the enclosures when, on alighting, Latham extracted the inevitable cigarette from the big case he always carried.

My most vivid memory is of the show put up by the young French pilot, Lefevre, who was flying one of the French-built Wright biplanes. It was in this, one afternoon, that he really thrilled a huge crowd. Lefevre's



Hubert Latham in flight in the graceful Antoinette monoplane in which he won the altitude contest by attaining a height of 500ft.

Wright machine was more easily and quickly manœuvrable than those of other early types at Rheims. On this particular flight he glided off his starting-rail quietly enough, and went skimming away across the aerodrome. But then he turned and came back towards the main enclosures. Nearer he drew, still steering straight towards them. Spectators stared in astonishment, and in some trepidation, as the biplane now seemed bearing right down on them. But just at the last moment Lefevre put his aircraft over in a bank which was by far the steepest I had so far seen. Right over the machine heeled, till one wing-tip just skimmed the grass, and a moment later the pilot was heading away, climbing quickly as he flew. Up he zoomed; then down he came in a dive which made onlookers gasp. After which, in front of the enclosures, he did things with that biplane which won round after round of applause. Nothing like it had been seen before. It was a revelation of what a dexterous pilot could do, already, with a machine responding quickly and accurately to its controls. Of course it was nothing compared with what one might see to-day. But to Lefevre, in my view, should go the credit of being the first pilot to give, in public, a display of anything like what we learned afterwards to call "aerobatics."

After the Day's Flying

The Rheims meeting had started on August 22nd, 1909, and during the week it lasted it was attended by a quarter of a million people. And there were altogether some 40 aeroplanes in the sheds, although all of them did not fly.

When proceedings were over for the day we used to gather for a talk in the pilots' big enclosure in front of the sheds. Here one could find, among others, such pioneers as Bleriot, Farman, Delagrange, Gabriel and Charles Voisin, Esnault-Pelterie, Capt. Ferber, Latham, Levavasseur, Paulhan, Rougier, Bunau-Varilla, De Lambert, Tissandier, Lefevre, Fournier, Curtiss, and Leblanc.

One evening our talk turned on by how many miles an hour the speed of aeroplanes might be expected to increase. Here even the most optimistic forecasts did not seem to go much beyond about 100 miles an hour, considerable doubt being expressed as to whether an aeroplane could be expected to stand up, structurally, to anything faster than that.

Sometimes we found ourselves looking far into the future. I recall how Robert Esnault-Pelterie broached one evening the subject of space-flight and interplanetary communication. Not long before that he had given a lecture on this subject to the French Academy

The then unsurpassed reliability of the new Gnome rotary engine enabled Henri Farman to win the duration prize with a flight lasting 3 hours 4 minutes. He is seen here during the actual competition; most of the flight was made at this very low altitude.

The First Air Display . . . . .

of Science, and I was much impressed by the confidence of this scientist and engineer that man's conquest of the lower zones of the air, and after that of the stratosphere, would in the onward march of science be followed by inter-planetary voyages.

Well, though 40 years represent a short enough time in any scientific research, some remarkable things have, in fact, already been happening. Already we have obtained an "echo" by radar from the moon. Already a two-step rocket has climbed 250 miles high. And in a year or so's time (experts who ought to know tell me) a pilotless rocket should have reached the moon's surface. In the meantime, I reckon myself lucky to have been able to sit under that pylon in France, away back in 1909, and watch the early pages of the world's aeronautical history being turned by the pioneers.

The Rheims speed contest was won by Glen Curtiss, flying this biplane, at a speed of 47 m.p.h.

Nautical Aeronautics

"Perchance: A History of British Naval Aviation." By B. J. Hurren. Nicholson and Watson. Price 10s. 6d.

AS a Fleet Air Arm officer and an executive of the Fairey Aviation Company, Cdr. Hurren has amassed a fund of naval-air lore unique in scope and rich in humour. On this he has drawn for various of the books already standing to his credit, and it has now served him well in his chronicling of the history of British Naval Aviation from 1909 to 1945. His style is easy, and his arrangement of facts—which took him seven years to collect—is orderly. Only in technicalities does he appear to have admitted anomalies: his own Company's Fulmar, for instance, he credits with a top speed of "nearer 190 m.p.h." than the 257 m.p.h. quoted as the official speed; on the other hand, he over generously ascribes to the Sea Mosquito a speed of more than 400 m.p.h. and a reconnaissance range of 3,500 miles at 315 m.p.h. Such discrepancies can, however, easily be remedied in future editions, to which, by virtue of its reference value and "readability," the work fully deserves to run.

The spirit which pervaded the Fleet Air Arm in wartime and with which Naval Aviation to-day is still, we know, imbued, is well exemplified by Cdr. Hurren's reference to the period of intensive training put in hand early in the war. Among the host of new regulations and controls, one was an immediate "clamp" on private flying. "At this time," he recalls, "there were some 70 light aeroplane clubs in Britain and a few score of private owners of aircraft. In the clubs were experienced flying instructors—mostly ex-R.A.F. officers, but some civilians—who were not exactly received with open arms by the R.A.F. In fact, many of their offers of service were cold-shouldered.

"Informal meetings thereupon took place in the Royal Aero Club, and in quick time the Secretary, Lieutenant Commander Harold Perrin, approached the Admiralty with an offer of a body of experienced pilots. The offer was snapped up eagerly and almost overnight the R.N.V.R. (A) Branch was established with a nucleus of ex-club instructors and private aeroplane owners and flyers.

"The Admiralty was not over-strict in its demands. One of the newly appointed officers who was later to render exceptional service, had had precisely 3 hours 5 minutes flying on light aircraft—a total entered by custom in his log book as '3.05 hours.' On completing the application form, this officer effected a Nelson touch by omitting the point—with the result that this 'experienced' officer of 305 hours' flying time was immediately despatched to Lee-on-Solent for a refresher course!"

As Lord Nelson himself put it, "We are few, but we are the right sort."

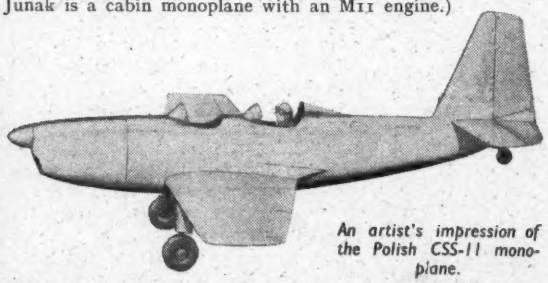
Publications Received

Directory of British Rubber Manufacturers and Products (export-trade directory in English, French and Spanish, for free distribution to buyers abroad). Federation of British Rubber Manufacturers' Associations, 43, Bedford Square, London, W.C.1.

Aircraft, by Douglas Palmer and A. C. Penney (elementary text-book for young readers). Price 3s, Edward Arnold and Co., 41, Maddox Street, London, W.1.

FOR POLISH SPORT

LIGHT aircraft now serving in Poland are mainly surplus Piper Cubs and Soviet Po-2 biplanes, though some of the newer Zak 1, Zak 2, Zak 4 and Zucha single-engine monoplanes are now on register. The Polish Air Lines, Polskie Linje Lotnicz, own a large fleet of ex-Soviet LI-2s, plus some Douglas C-47s, French-built Languedocs and Cessna Bobcats, while Air Force equipment includes Yak-9 fighters, Pe-2 and Il-2 bombers, Soviet UT2 and Polish Junak trainers. (The Junak is a cabin monoplane with an M11 engine.)



An artist's impression of the Polish CSS-11 monoplane.

The latest design by Poland's *Centralne Studium Samolotow* is a two-seat low-wing monoplane—the CSS-11—available in two versions, one a tourer, the other aerobatic. Both are powered by a single Walter Minor 6-III engine of 160 h.p. Dimensions are: span 34.7ft, length 24.6ft, height 7ft. Loadings and performance are as given in the next column:—

	Tourer	Aerobatic
Weight loaded	2,178 lb	1,870 lb
Cruising speed	106 m.p.h	111 m.p.h.
Maximum speed	140 m.p.h.	147.7 m.p.h.
Landing speed	53.2 m.p.h.	50.6 m.p.h.
Ceiling	21,000ft	24,000ft
Range at 60 per cent power	676 miles	617 miles
Length of run from start to 65ft	425 yd	370 yd

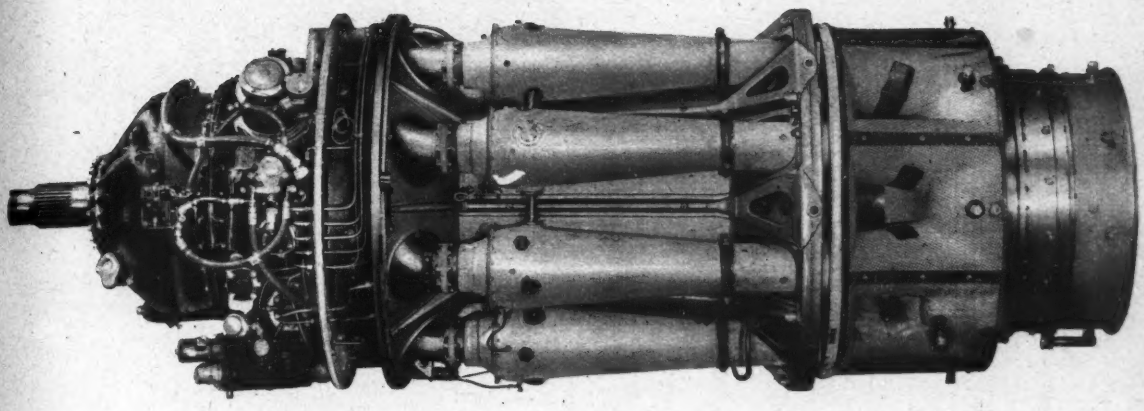
STANDARDIZATION

AT the 48th Annual General Meeting of the British Standards Institution on July 27th, the President (the Rt. Hon. Lord McGowan, K.B.E.) referred to the greatly increased interest during the past year both by industry and the Government in the extension of voluntary standardization on a national basis. The investigations by the Committee for standardization of engineering products set up by the Ministry of Supply under the chairmanship of Sir Ernest Lemon have substantiated the view, long held by British industry, that the principles under which the B.S.I. works are effective and can be extended.

The Anglo-American Productivity Council has recently stressed the importance of standardization and Lord McGowan submitted that there is probably no more effective means of increasing productivity. Another significant development during the past year had been the co-operation of the great nationalized industries with the B.S.I. and the increase in the collaboration amongst large industrial users with a view to assisting makers to reduce the number of types and sizes.

Mr. Roger Duncalfe, the Chairman of the Institution, said that the Government and industry have jointly agreed that industrial standardization should be effected through the B.S.I. as the national standards body.

BRISTOL PROTEUS



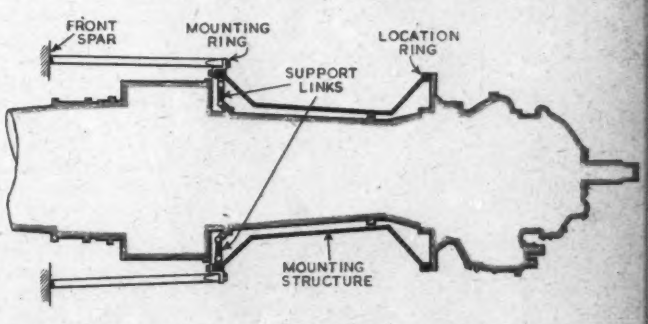
A High-compression Turboprop for Wing Mounting

WHEN a new aircraft power unit is projected most careful examination of a number of long-range considerations must be conducted before a decision to proceed is taken. Some years must elapse before the unit is developed for commercial production and when that stage is reached it must be able to exceed or at least meet current requirements. The mechanical and thermodynamic design must be sufficiently advanced to avoid the risk of being out-moded and flexible enough to permit full advantage to be taken of any new materials or fuels which may become available. Further, the type, size and operating conditions of aircraft for the period ahead must be envisaged with sufficient accuracy to ensure acceptance of the new unit. A firm building both aircraft and engines is advantageously placed in this respect, but, even so, a decision is not easily arrived at.

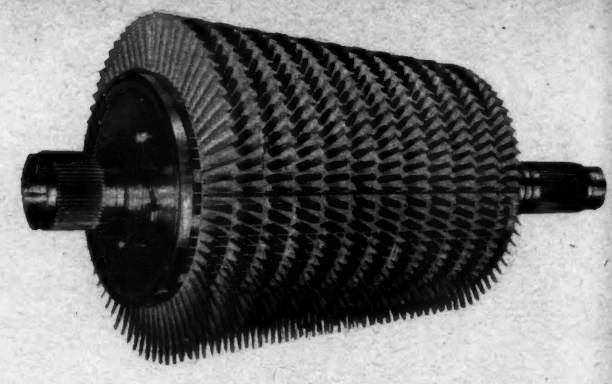
The Bristol Proteus project, now approaching fruition, bears evidence of admirable foresight and appears to be a happy solution of the many conflicting factors. At the inception it was reasonable to expect that for the ensuing decade the bulk of civil and transport flying would be accomplished at medium speed and medium altitude. The Theseus turboprop, particularly intended for civil operation, was undergoing development for an output of 2,500 equivalent shaft horse-power. Aimed to meet the requirements of somewhat larger craft of improved performance, the Proteus was projected for an initial output of 3,500 equiv. s.h.p. For higher outputs two Proteus units could be coupled by gearing to drive counter-rotating airscrews, as planned for the Brabazon 2 installation. The Proteus was conceived on somewhat bolder lines than the Theseus, with emphasis on minimum overall diameter to make it suitable for buried installation in the wings. To this end it is designed for lateral air intakes, although a peripheral intake can be arranged if desired.

It would be erroneous to regard the Proteus as merely a scaled-up version of the Theseus. Certainly there are mechanical similarities, such as the axial compressor with a terminal centrifugal stage and the independence of compressor and airscrew turbines. (The so-called "free turbine" system, incidentally, promises to characterize Bristol designs.) Fundamentally, however, the two units represent different methods of tackling the same problem. As both were intended primarily, but not exclusively, for civil applications a relatively low specific fuel consumption was of major importance. With the Theseus the aim was to achieve this end by utilizing a medium compression ratio, actually about 4.25:1, and eventually a heat-exchanger. For the Proteus no heat-exchanger is contemplated but, instead, a compression ratio "very substantially" higher than that of the Theseus is the thermodynamic basis of the design.

With the unit rotating at the designed maximum speed of 10,000 r.p.m., the high ratio of compression is achieved by means of twelve axial stages followed by a single centrifugal stage. Air enters by way of eight smoothly swept radial passages in a fabricated steel casing which bridges the structure between the compressor and turbine casing. The passages are defined between tubular members which enshroud the ends of the combustion chambers leading to the turbine entry. The air mass flow is approximately 45 lb/sec. On account of the high rotational speed the axial rotor is of disc construction. Twelve discs of forged R.R.58 light alloy are clamped between the flanges of hollow S.96 steel end shafts by eight long bolts. Torque is transmitted from disc to disc and shaft flange by eight rows of dowel pins, pitched between the clamping bolts which are thus relieved of shear stress. Rotor blades, of low camber and high speed airfoil section, are forged in L.42 light alloy, coined, machined and finally anodized as a precaution against corrosion. Blade roots are of "fir-tree" shape, fitting in axial grooves in the rotor and spaced between stages by distance pieces. It is of interest that the blades are produced to the same profile and to common



The complete unit is suspended, with freedom for expansion, in a cylindrical mounting structure.



(Left) The fabricated air intake has apertures which permit it to clear the gas conduits. (Above) Assembled rotor of axial compressor.

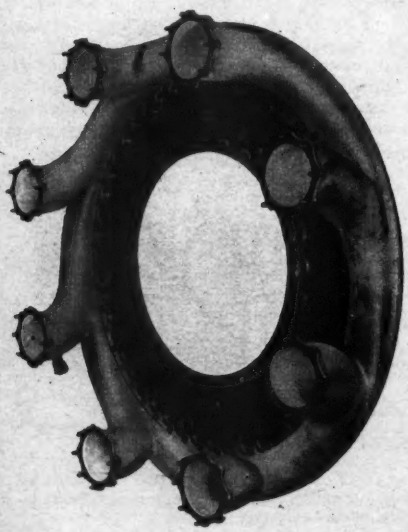
Bristol Proteus . . . . .

length and are cut down to appropriate lengths for the various stages. All are given a rubbing relief at the tip.

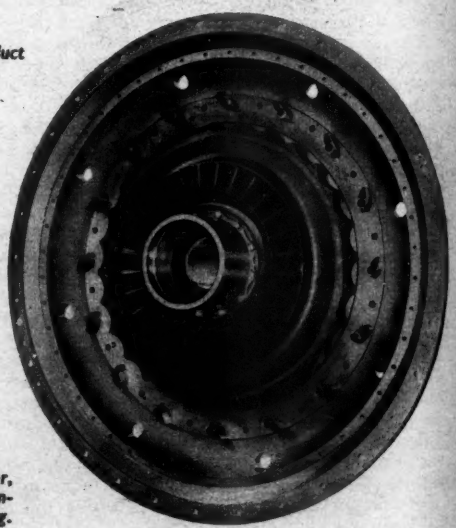
The same material and method of production is used for the stator blades which have rectangular roots of a segmental dovetail section. These blades are fitted in circumferential grooves in the stiffly proportioned, divided compressor casing. In each half the blades are retained by steel strips bolted to the casing at the parting line and each row is clamped by two radially-positioned taper bolts. The stator casing also carries a row of entry guide blades to direct the incoming air to the correct angle of attack for the first-stage rotor blades.

On the Theseus the last axial stage delivers directly to the entry vanes of the centrifugal impeller but on the Proteus the two components are axially spaced and the air passes from one to the other by way of an annular trunk in the intermediate casing. In the trunk are eight streamlined guide-vanes which serve to support the centre section housing the two ball-bearings carrying the front end of the compressor shaft. In view of the high speed of rotation and the temperature-rise in the air in the axial compressor, the double-shrouded centrifugal impeller is milled from a forging of S.96 steel. It is registered and bolted to a hub splined on the rotor shaft and is furnished on each side with labyrinth seals to prevent the highly compressed air escaping to either the intermediate casing or the accessories gear casing. The ring of curved entry vanes, also of steel, is produced separately and bolted to the impeller.

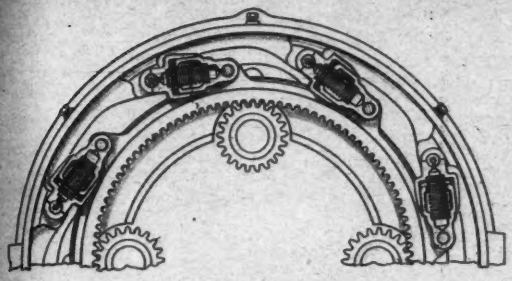
To the necked diffuser casing of the centrifugal compressor are directly attached the eight "straight-flow" combustion chambers arranged compactly around the axial compressor casing. Chambers are somewhat longer than are contemporary units, to ensure thorough dilution and even temperature of the gases before reaching the turbines; otherwise they are of conventional design, with the outer casing of S.84 mild steel and the flame-tube of Nimonic 75 nickel-chrome alloy. Following what has now become almost common practice, the combustion air enters a small swirl casing through a metering orifice and the flame is fed by primary and secondary series of holes in the tube. Radial pins in the casing position the flame-tube upstream while the downstream end is fitted with a spacing ring and is free to slide to permit expansion. The air space is continued in the junction pipe connecting the end of the chamber to the turbine entry. Chambers are interconnected by the usual pressure balance pipes which also serve for the propagation of flame when starting up. Only two chambers are fitted with igniter plugs. So-called "manacle" joints, comprising divided, V-section clamping rings, replace

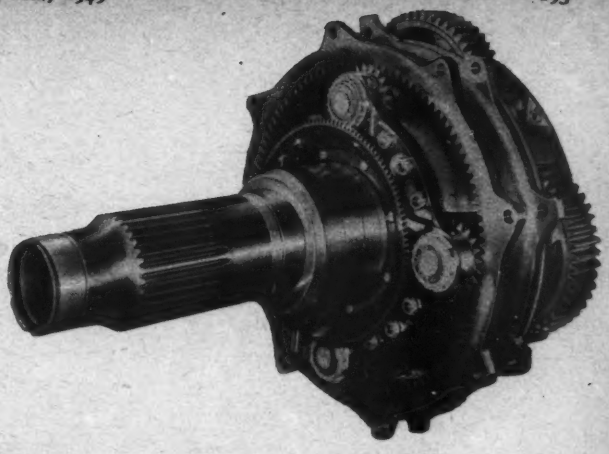


(Left) Eight-branched delivery duct of the centrifugal compressor.



(Right) Fully shrouded impeller, with attached entry vanes, mounted in the diffuser casing.



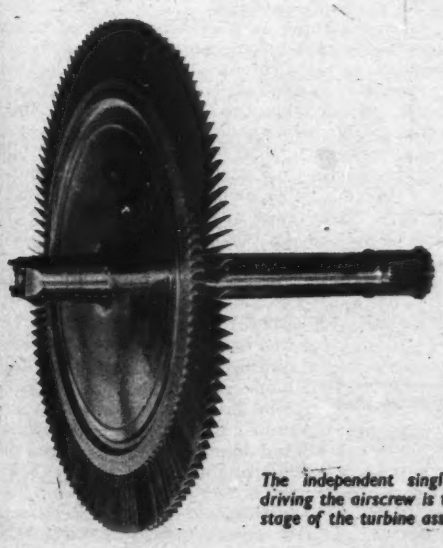


(Above) Arrangement of the torquemeter pistons and ring gear.
(Right) The airscrew reduction gear is of the compound epicyclic type.

the usual screwed or bolted joints of the combustion equipment. Fuel is supplied by a Lucas variable-displacement pump delivering at a pressure of 750 lb/sq in. Atomization of the fuel is effected by Lucas Simplex-type burners mounted centrally in the flame-tube. Control equipment—barometric pressure-control unit, accumulator and throttle cock—is also of Lucas design.

Combustion gases are expanded in three turbine stages: two provide the power necessary to rotate the compressor system and the third furnishes an independent drive for the airscrew. All three wheels are of Jessop G.18B steel and carry blades of Nimonic 80A alloy with fir-tree roots. The first wheel has a short integral shaft on which is secured the outer member of the toothed coupling to drive the compressor rotor. First and second wheels are clamped together by a sleeve passing through their bores and torque is transmitted by interengaging radial serrations on the abutting disc faces. This compressor turbine-wheel assembly is overhung from two bearings housed in the hub of the mounting spider. Thrust from the turbine is taken by the rearwardly located ball bearing while the other bearing is of the roller type. The toothed coupling permits independent axial expansion of turbine and compressor components.

Turbine nozzles are built up of multi-blade segments, precision-cast in Nimonic 80 alloy by the lost-wax process.



The independent single wheel driving the airscrew is the third stage of the turbine assembly.

The segments are bolted to the diaphragm located forward of each turbine disc and carrying labyrinth seals. On account of the substantial pressure drop through the turbines the nozzle area is increased considerably from entrance to exit at the second and third stages. To avoid a too-rapid expansion of the gases the nozzle blades, therefore, are of relatively long section.

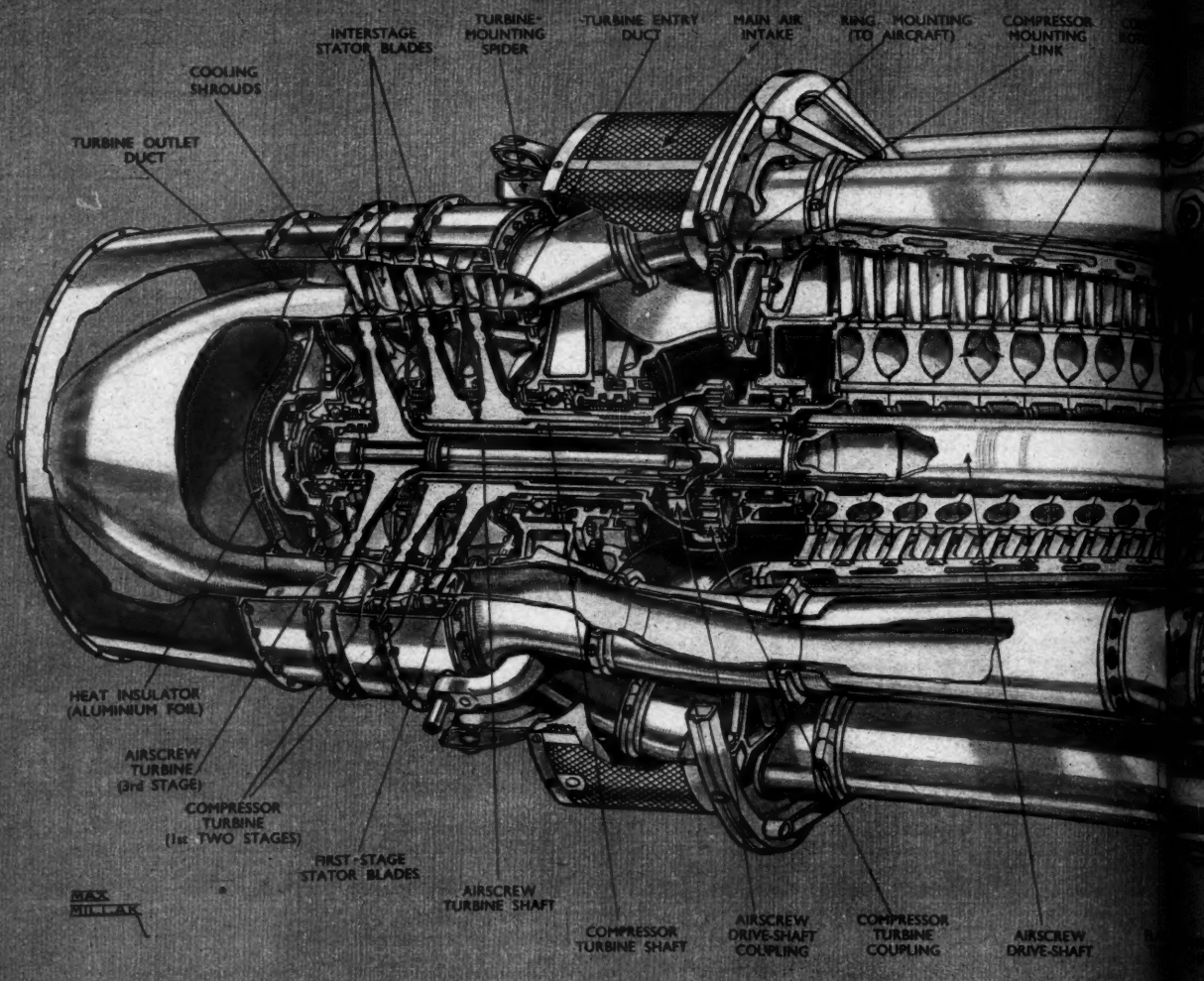
As the gases expand through the stages their temperature is lowered and, as a consequence, the turbine components can safely withstand higher mechanical stressing. Advantage is taken of this factor in the third stage to run the airscrew turbine-wheel at 10,700 r.p.m. instead of the 10,000 r.p.m. of the compressor wheels. Thrust from this wheel is taken on a ball bearing located in the rear casing, and the tubular shaft, flanged to the disc, extends through the sleeve clamping the first- and second-stage wheels and carries the male member of the toothed coupling connecting to the drive shaft. This tubular shaft passes right through the axial compressor rotor, the centrifugal impeller and the accessories drive casing and terminates in a second toothed coupling by which the drive is transmitted to the reduction gear. Ball and roller bearings, at front and rear respectively, support the shaft in the compressor rotating assembly.

Turbine-disc cooling

Three supplies of air at different pressures are tapped from the compressor to cool the turbine discs. For the first-stage turbine, at which the gases are at high pressure, air is piped from the centrifugal compressor casing in the vicinity of the impeller periphery to two arms of the turbine spider. From one of these a flow passes through drillings and holes in the diaphragm to the shroud and thence up the forward face of the first disc. The supply to the second arm passes through drillings in the hollow turbine shaft and longitudinal grooves in the exterior of the sleeve inside the shaft to the rear face of the first disc and, after passing through a labyrinth seal on the diaphragm, to the forward face of the second disc.

Air at somewhat lower pressure, also tapped from the centrifugal-compressor casing, is led down a third arm of the spider to a space in the centre of a labyrinth seal on the turbine shaft. By way of drillings in shaft and sleeve it reaches the annular space between the sleeve and the airscrew shaft and thence passes up the rear face of the second disc.

For the airscrew turbine, the third disc, air is piped from the seventh and sixth stages of the axial compressor to the rear of the turbine casing and thence to the housing of the bearing for the rear stub shaft of the disc. That from the seventh-stage tapping is passed by a drilling to the centre of a labyrinth seal and thence by a drilling in the stub shaft

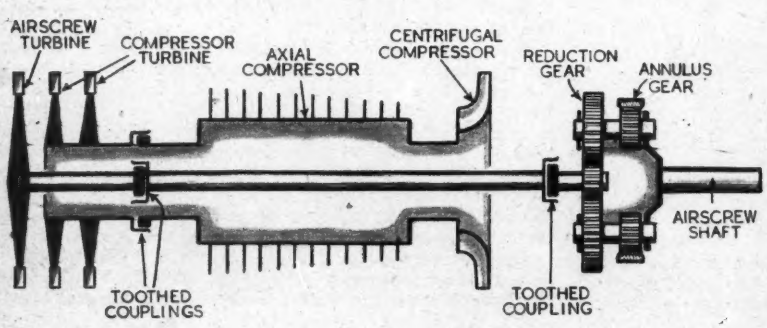


Bristol Proteus . . . . . .

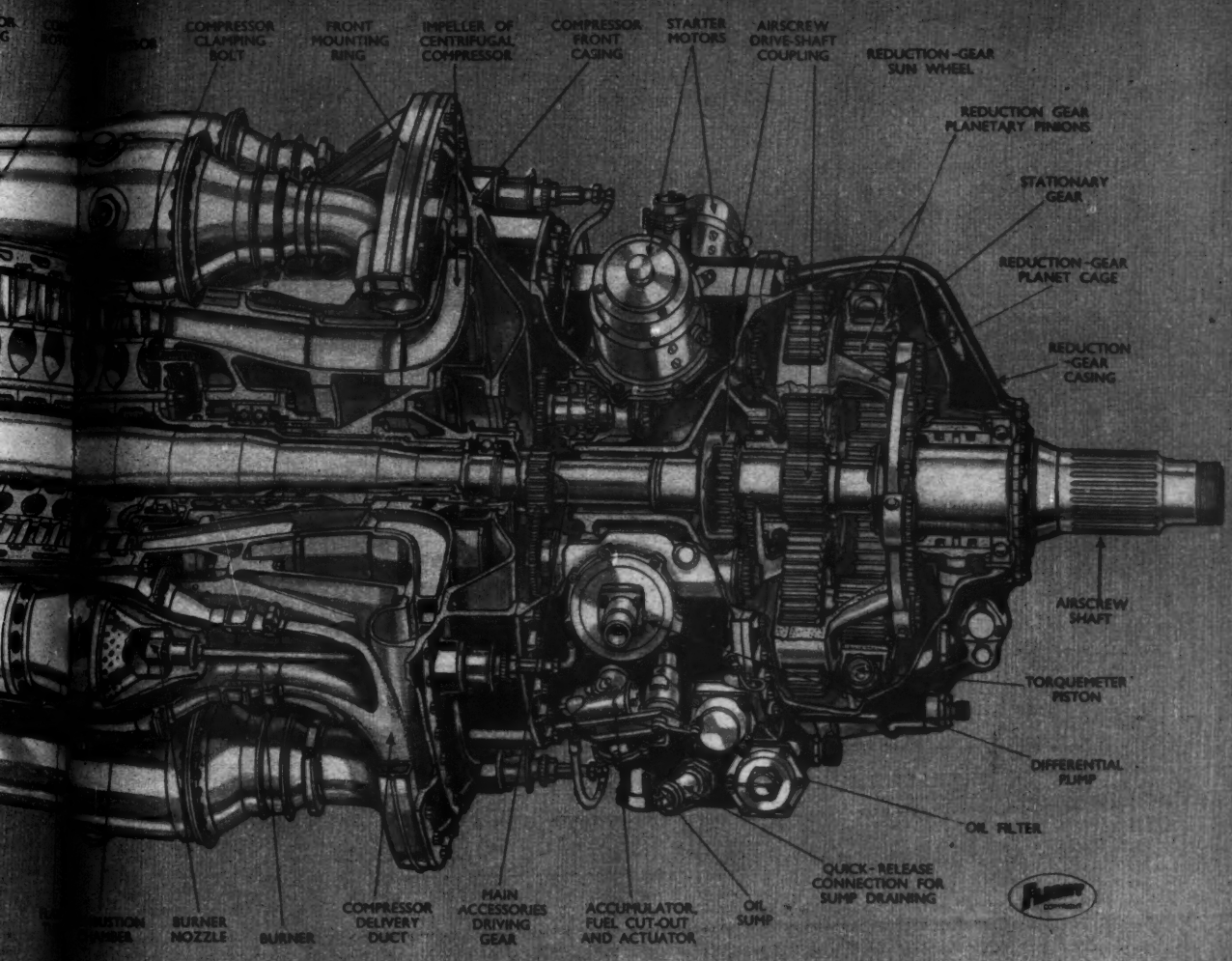
through the central bore of the disc. From the forward end of the bore it passes between the flange of the airscrew turbine shaft and the hub of the disc, through grooves in the junction face and thence up the forward face of the disc. For the rear of the third-disc air from the sixth-stage tapping is delivered as a jet into the open central mouth of the shroud arranged adjacent to the rear face.

In addition to cooling the turbine discs these air supplies, which reach the wheel discs at pressures slightly higher than those of the gases at their particular stage, serve as seals between the blade roots and the nozzles and prevent the escape of hot gas to the interior.

Some idea of the importance and magnitude of the blade-production problem on turbine units may be gained from an examination of the Proteus. On the axial compressor there are twelve rows each of 69 blades with fir-tree roots for the rotor and, including the entry guide vanes, thirteen rows each of 70 blades with dovetail roots for the stator. This gives a total of 1,738 die-pressed, light-alloy blades. Three turbine wheels each carry 127 nickel-chrome alloy blades machined from the solid bar, thus totalling 381 blades per unit. Turbine nozzle blades, also of nickel-chrome alloy, are cast in groups of seven for the first stage and of three for the succeeding stages. There are 112 blades in the first stage and 48 in each of second and third stages, making in all 208 blades in 48 castings. The sum total is thus 2,327 blades (or 2,167 items) in three different materials and manufactured by three different production techniques.



Diagrammatic assembly of the rotating components connected by toothed couplings.



This special "Flight" sectional drawing reveals the layout of the Proteus, which differs radically from that of the earlier Theseus. By means of a rear intake and a reversal of flow after the centrifugal compressor, compactness and a reduced diameter are obtained. Representing the latest version to date, the drawing includes some details which may be altered in the future as development "mods" are incorporated.

To reduce the turbine speed to a value suitable for efficient airscrew operation a compound epicyclic gear is used. Alternative ratios of 11.1: 1 and 11.9: 1 are available. Torque is supplied to the sun wheel and the first reduction is to the larger wheels of the four planetary pinions. The smaller wheels of the pinions engage a "fixed" ring gear providing the second reduction and causing the planetary axes to rotate around the sun wheel. To the cage carrying the planetary pinions is flanged the airscrew shaft and the complete assembly is mounted in a roller and a ball bearing at rear and front respectively.

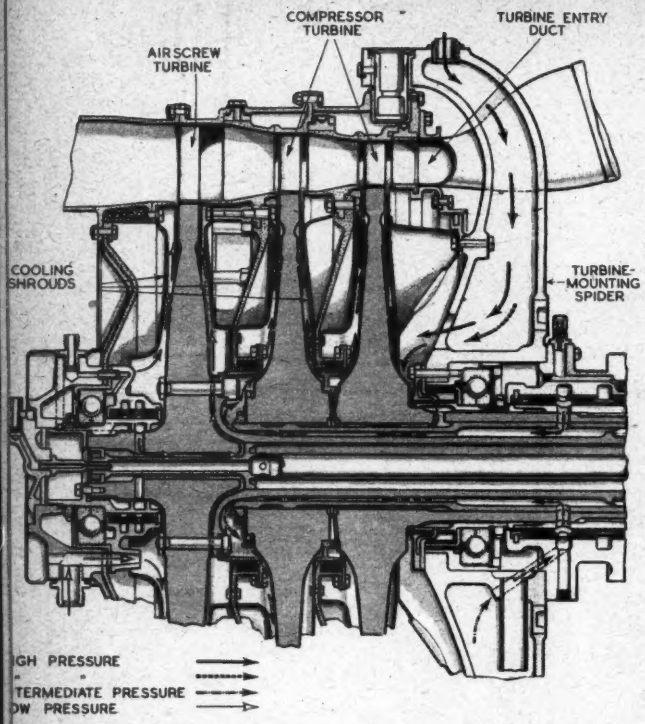
The so-called "fixed" gear is actually floating and the load on it is balanced by a torquemeter system of eight cylinders and pistons under oil pressure. By this means a continuous indication of turbine performance, and of the power supplied to the airscrew, is provided.

Two starter motors, each arranged laterally and inclined at 50 deg to the vertical, drive a bevel gear and, through a dog clutch, a spur gear engaging a pinion splined on the forward end of the compressor shaft. On later versions only a single starter may be fitted. From the compressor pinion through spur and bevel trains are driven the oil pumps, the fuel pump and a spare drive for any other accessory.

One of the drives for the differential pump is also taken from this pinion; the other is from a gear wheel bolted to the rear of the planet cage of the reduction gear. The function of this component is to maintain the rotational speed relationship of compressor and airscrew turbines; it is a reversible three-pinion pump with the centre pinion, taking its drive from the airscrew assembly, flanked by two idler pinions. The pump casing is mounted on a gear-wheel and rotated from the compressor. In principle, when compressor and airscrew turbines are running at their designed ratio (10: 10.7) relative rotation of casing and pinions is nil. Should the ratio deviate from the correct value, relative rotation will occur in one or the other direction. If the airscrew-turbine speed is too high the pump delivers oil to one side of the hydraulic valve controlling airscrew blade pitch and coarsens pitch until the ratio is restored. Should the airscrew-turbine speed be too low the

DIMENSIONS AND DATA

Length (jet pipe omitted)	113.35in
Overall diameter	38.5in
Weight (bare)	2,900lb
Airscrew rotation	L.H. Tractor
Airscrew shaft	S.B.A.C. No. 6, standard
Reduction-gear ratio	0.09 : 1 or 0.084 : 1
Compressor turbine	10,000 r.p.m.
Airscrew turbine	10,700 r.p.m.
Output (sea level, static)	3,200 s.h.p.+800lb thrust
Output (35,000ft, 350 m.p.h.)	1,260 s.h.p.+560lb thrust
Fuel consumption (sea level, static)	0.688lb/s.h.p./hr
Fuel consumption (35,000ft, 350 m.p.h., airscrew efficiency 80 per cent)	0.510lb/equiv h.p./hr



Assembly of compressor- and airscrew-turbines showing paths of the cooling-air supplies and the shrouds over the discs.

Bristol Proteus . . . . .

pump reverses its rotation and delivers oil to the other side of the control valve with opposite effect.

In practice, it is arranged that when the compressor-to-airscrew ratio is correct the pump is rotating at 34 r.p.m. to produce sufficient pressure to balance a spring biasing the control valve towards fine pitch. This pre-loading of the valve is provided, of course, to impart sensitivity to the control.

From the service tank, the pressure pump can deliver oil at 1,000 lb/sq in, but a relief valve lowers this value to 650 lb/sq in. At this pressure it is fed past a check valve to the airscrew pitch control mechanism and to a reducing valve. Here the pressure is lowered to 80 lb/sq in for a three-branched service. One branch delivers to an annulus on the airscrew shaft and thence to the planet gear spindles and to jets playing on the sun and planet gear teeth. A supply is also taken to two check valves for the respective input sides of the differential pump. The second feeds the torquemeter pump, where the pressure is boosted for delivery to the torquemeter pistons. From the third branch a reducing valve drops the pressure to 30 lb/sq in for all the accessory-drive bearings and the metering-pump intake. This unit has six plungers actuated by a barrel cam, individual deliveries being adjustable by means of ported cylinder sleeves:—

(1) To the drive shaft front ball bearing.
(2) To the two ball bearings at front of compressor rotor.
(3) To roller bearing at rear of compressor rotor, roller bearing at forward end of compressor—turbine shaft, and to coupling.
(4) To ball bearing of compressor-turbine shaft.
(5) To ball bearing at rear of airscrew-turbine shaft.
(6) Into rear end of airscrew-turbine shaft and by an axial tube to the roller bearing for the rear of the drive shaft, in which the turbine shaft has a pilot bushing. Drains through both turbine couplings.

Drains lead to the sump in the base of the accessories drive casing from which the scavenge pump draws the oil through a strainer and returns through an external cooler to the service tank.

If a reversing screw is fitted, a solenoid valve is provided to cut out the 650 lb/sq in relief-valve from the pitch-control circuit and make 1,000 lb/sq in pressure available to speed movement through fine pitch to reverse. An independent, electrically driven feathering pump shuts the line from the pressure pump and moves the blades through coarse pitch to feather.

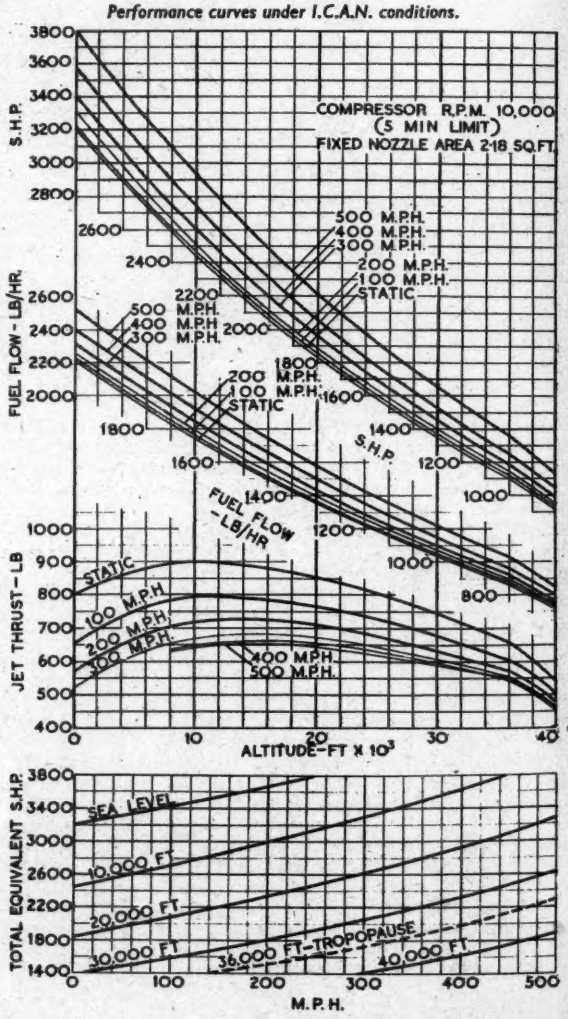
Oil consumption is characteristically low. On the Theseus 500-hr test the rate averaged about 0.25 pt/hr and the Proteus rate is similar. For a piston engine of equivalent output oil consumption would be from 6 to 8 pt/hr.

The complete power unit is mounted from a hollow ring formed of two rings of channel section welded together at their web extremities. A longitudinally ribbed cylindrical sheath of sheet steel with flared end-flanges, dubbed a "corset" in the workshops, is bolted to the front face of the mounting ring, and at its forward end another hollow ring supports the end of the compressor casing assembly and the accessories-gear casing. At the rear the compressor is suspended from the mounting-ring by eight shackle links hinging on radial pins to permit axial and radial expansion.

The turbine section is spaced from the rear of the compressor by the air intake. Passing through the intake structure, the eight arms of the spider carrying the compressor-turbine bearings pick up on the structure by radial pins. To the rear of the turbine casing is bolted the jet-pipe. In the example shown this is of fixed area, but the design may include a jet nozzle in which the area is automatically variable by means of shutter flaps to ensure optimum velocity for the obtaining operating conditions.

F. C. S.

Performance curves under I.C.A.N. conditions.



ATHENA MARK 2

Pre-production Development of the Avro Advanced Trainer

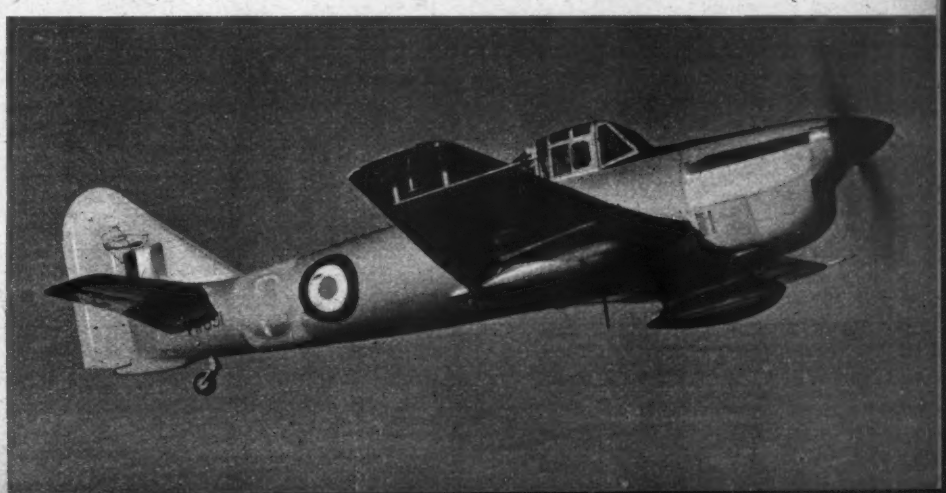
WHEN, in *Flight* of April 8th, 1948, the Mamba-powered Avro Athena Mk 1 was described in detail, brief reference was made to the Mk 2. The major differences between these types are concerned with power unit and with wing position, the fact that the Mk 2 employs a Rolls-Royce Merlin 35 in place of the Mamba turboprop having necessitated the wing being moved 27in forward to cater for the resulting re-positioning of the c.g. Naturally enough, in the light of development time, there have been additional modifications and refinements to the aircraft, but none of these has been of a fundamental nature, and essentially the Athena remains as originally designed.

The slim, unbroken nose-profile made possible by the Mamba turboprop installation must necessarily be sacrificed when a piston engine is used, but Avros are to be congratulated on the manner in which they have cowled the Merlin on the Athena 2. Certainly, the profile line is disrupted for the chin positioning of the coolant and oil radiators, but apart from this there are no excrescences about the power plant to increase parasitic drag. It is also of considerable interest to record that the Athena 2 power plant is an Avro unit and, in fact, is the first that the company has ever done. Usually, power plants are supplied complete by the engine manufacturer for attachment as a sub-entity to the airframe. In the instance of the Athena, however, the engine and all relevant subsidiaries are supplied to Avros, who then build them up into a power plant of their own design. There has, of course, been close liaison between Rolls-Royce and A. V. Roe and Company on this matter, the effectiveness of which is pointed by the fact that the Athena power plant was successfully passed through the Rolls-Royce Hucknall "course" quicker than any other power plant previously handled there.

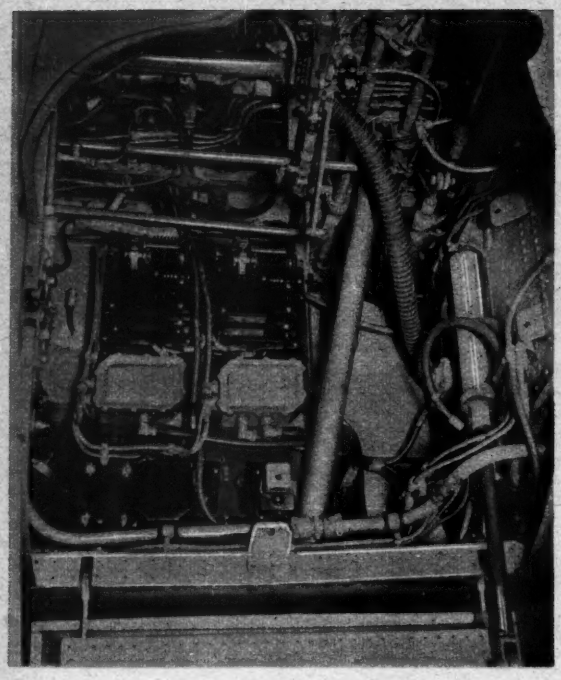
The Merlin 35 is, in fact, a Mk 24 employing a Mk 32 blower, and gives 1,280 b.h.p. for take-off at 3,000 r.p.m. and 12 lb/sq in boost. Whereas the power output of the Mamba in the Athena 1 is absorbed by a three-blade D.H. Hydromatic airscrew of 9ft 6in diameter, the greater power of the Merlin demands a four-bladed airscrew of 10ft 9in diameter; this, too, however, is a de Havilland constant-speed Hydromatic unit.

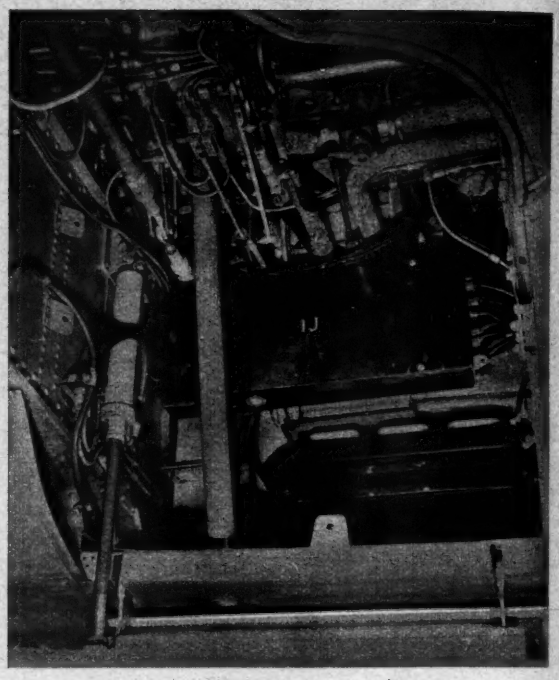
In view of the fact that the engine auxiliaries comprise only a vacuum pump, a compressor and twin generators, the use of a separate auxiliary gear box has been obviated and the units are mounted on engine face-pads for direct drive. Cold air to the carburettor for take-off, climb and landing approach is entrained, port and starboard, through flush-closing venetian-blind intakes (behind which are filter tray units) in each of the cowling side-panels. In cruising conditions, the engine is supplied with warm air in that the intake is positioned immediately behind the coolant radiator.

A new layout has been adopted for the fuel system.



The workmanlike appearance of the two-seat Athena 2 in the air is retained when on the ground, as the heading picture shows. It should be noted that the yaw-meter on the starboard wing-tip and the guards for the rudder mass-balances are development items which will not, of course, be seen on production machines.





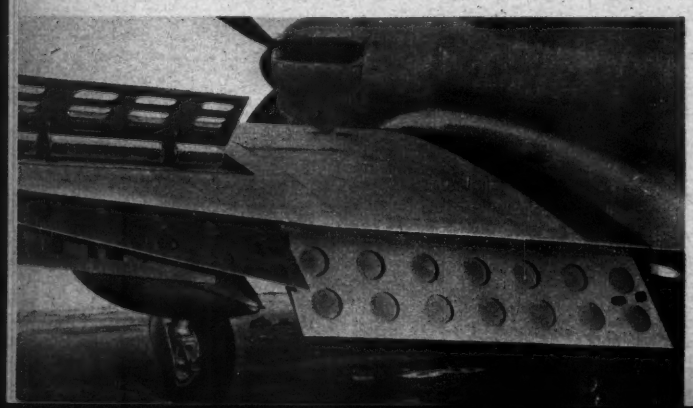
Accessibility for maintenance has received great attention in the Athena design, as the above photographs clearly show. On the left is a view into the port wheel-well showing the control linkages beneath the cockpit floor and the ducting of the cockpit heating system. At right is the starboard wheel-well in which can be seen the main junction-box and, below it, the batteries. The large pipes raking down in each well are dust tubes

Originally, the tankage comprised a saddle tank immediately behind the engine firewall, and port and starboard tanks in the wing centre-section. The latter tanks have been retained but the central tank is now carried beneath the cockpit floor in the position originally occupied by the jet tailpipe, and the scuttle accommodation is given over to the oil tank and the glycol tank for windscreen de-icing spray. All the fuel tanks (by Fireproof Tanks, Ltd.) are of crash-proof, bag-type construction. Use of the Merlin allows a somewhat smaller tankage capacity and the 140 gallons carried by the Mk 2 give a duration of 2¾ hours. Provision is also made for a pair of 45-gallon drop tanks—which, in point of fact, are slightly modified Tempest components—whereby the duration is extended to 4¼ hours.

Apart from re-orientation of the central fuel tank, the fuel system itself has been modified to make it as simple and foolproof as possible. To this end, a single on/off cock is used, the final portion of opening travel of which energizes the fuel booster pump, whilst the final closing movement of the cock operates the slow-running cut-out. Air from the exhaust side of the vacuum pump is used to pressurize both drop tanks (when fitted) and also the port and starboard centre-section tanks. If drop tanks are being employed, their fuel is first used, after which transference of fuel feed from the wing tanks is made automatically. Fuel from the drop tanks and wing tanks is commonly fed into the central tank which houses the booster pump and from which the engine is supplied.

Behind the oil and glycol spray de-icing tanks in the scuttle are access holes whereby the retractable amber screens used (in conjunction with blue goggles) for simulated blind flying may readily be cleaned; these holes also provide a measure of access to the backs of instruments on the facia panel. The canopy has been made somewhat smaller on the Athena 2 as the original rear seat installed in the Mk 1 has been deleted. The smaller canopy has effected a profitable weight-saving and, at the same time, the opportunity has been taken to improve the actuating mechanism, particularly for emergency jettisoning. In addition, the front screen has been strengthened by the employment of toughened instead of plate glass, whilst, in place of the tubular steel triangulated crash pylon used on the Mark 1, a heavy, built-up box-section arch is substituted, this also serving as the front frame of the rear canopy fairing. Deletion of the rear seat has also permitted a re-positioning of the radio stowage. Originally, the radio equipment was located behind the third seat, but it has now been brought forward into the vacant space so, incidentally, affording a considerable improve-

Dive brakes are now separate units which retract flush into recesses in the top and bottom wing surfaces ahead of the outer flaps.



The Merlin 35 Avro power-plant is mounted to the Athena fuselage at four points. An engine change should be a matter almost of minutes.

Athena Mark 2 . . . . .

ment in accessibility, and therefore in convenience.

Cockpit heating is achieved by warm air supplied through a heat-exchanger tapped off the engine coolant system. A pipe taken from the radiator by-passes coolant through the heat-exchanger and so back into the engine system, the cockpit temperature being regulated by varying coolant-flow through the heat-exchanger. This installation, as may be seen from the photographs, is housed beneath the cockpit floor. A rigid grid-type structure is used for the floor of the cockpit, the side members forming the lower longerons of this part of the fuselage. Wing/fuselage union is made through forged lug fittings on the longerons, picking up with pin joints to fork fittings bolted on the top booms of the centre-section spars. The essential simplicity of this construction introduced little difficulty when it became necessary to move the wing forward to accommodate the greater weight of the Merlin; it merely meant that the lug fittings on the longerons had to be shifted forward the requisite amount.

Flight-control Improvements

Transmission linkage in the primary flight control system has been refined, the push-pull tubes having been given straighter runs, so that the number of pivot points has been reduced; this, in turn, has diminished the already very slight amount of backlash which existed in the system. Control-surface tabbing arrangements have also been modified somewhat in that the single spring tab (which could be biased for trimming purposes) on the Mk 1 rudder has, on the Mk 2, given place to a pair of tabs, the upper of which is a normal trim tab, whilst the lower is a plain spring servo tab. Ailerons are fitted with spring tabs for servo assistance, but have no trimming surfaces, whilst the opposite applies to the elevators, i.e., trim tabs are used without spring servos.

The fact that airscrew torque reaction is noticeably greater with the Mk 2 power installation than with the Mk 1 has meant that the original Mk 1 fin area has had to be increased by 5 per cent on the Mk 2, the respective increase in rudder area being no less than 22 per cent. A slight change of fin and rudder profile is thus noticeable, but the more important result of this modification is that the Athena 2's swing characteristics at take-off and directional trim during climb are claimed by Avros to be better than any fighter employing a single piston engine with uni-directional airscrew. This point will, no doubt, be emphasized when *Flight* is able to sample the Mk 2 in the air.

Some change in dive-brake design has also been made. Whereas the first Athenas had the outboard flaps recessed into that portion of the trailing edge which could be swung vertically to act as a dive brake, the current system in no way affects flap arrangements, as the braking surfaces are housed in wedge-section recesses formed in the upper and lower wing surfaces clearly forward of the outboard flaps. This is admirably shown in the accompanying photograph.

Development work with the Mk 1 Athenas is still in progress, the first prototype being at Woodford, whilst the second prototype is at the main Chadderton factory. The latter machine is kept company by a Rolls-Royce Dart-powered Mk 1 which, perhaps, might be referred to as a Mk 1½, in that Mk 2 outer wings with the revised dive brakes are employed, together with sundry other refinements which characterize the later versions. This Dart-Athena is also experimentally fitted with an electrical system in place of the pneumatic system with which the Athenas are normally equipped.

The first prototype Mk 2 is at present undergoing tropical operation trails at Khartoum, whilst the second prototype is still down at Boscombe. So far, of the pre-production order of 17 Athena 2s, five are in course of construction, and one is at Woodford being prepared for its initial flight trials.

DATA
AVRO ATHENA MK 2

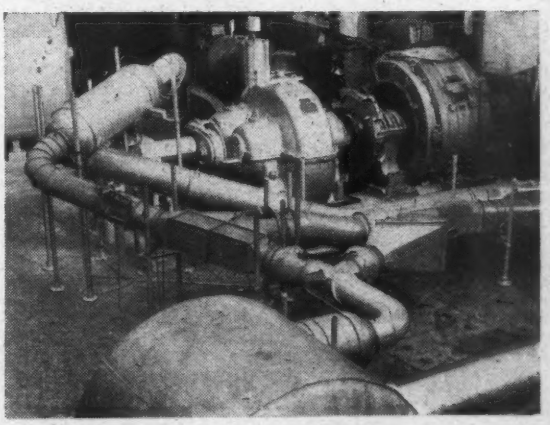
Dimensions	
Span	40ft
Length	37ft 6½in
Height, tail down	12ft 10in
Gross wing area	270 sq ft
Wheel track	12ft 9in
Performance	
Max. speed at 10,000ft	298 m.p.h.
Max. cont. cruise at 10,000ft	277 m.p.h.
Max. cont. cruise at 15,000ft	268 m.p.h.
Max. W.M. cruise at 10,000ft	230 m.p.h.
Rate of climb at sea level	1,830ft/min
Rate of climb at 10,000ft	1,600ft/min
Rate of climb at 15,000ft	1,160ft/min
Service ceiling	29,700ft
Take-off to unstick	300yd
Take-off to clear 50ft	625yd
Landing from 50ft to rest	690yd
Ground run	310yd
Weight Analysis (Normal Dual)	lb
Tare weight	6,540
Navigation instruments	3
Oxygen	35
Miscellaneous	52
Radio	127
De-icing fluid	7
Instructor	200
Pupil	200
Fuel	900
Oil	68
Normal take-off weight	8,132
Desert equipment	158
Drop tanks	104
Drop tank fuel	648
Overload take-off weight	9,043lb

Brabazon I Pressurization

THE pressure side of the cabin atmosphere control system in the Brabazon I is vested in a pair of Marshall cabin superchargers mounted vertically on the accessory gear boxes aft of the inboard coupled power plants.

These Roots-type positive-displacement blowers each deliver 60 lb air/minute at an altitude of 25,000ft in order to give an equivalent cabin altitude of 8,000ft. All the equipment comprised in the installation has been tested by Sir George Godfrey and Partners in conjunction with the Ministry of Supply and Bristol Aeroplane Co., the operating trials having included the determination of pulsations within the ducts and the vibration levels and pressure losses throughout the system.

The advantages inherent in the essentially simple system of pressurization employed include the obviation of speed-controlling gear boxes. The superchargers are easily removed for servicing operations and, whilst the simple design makes possible a low initial cost, there is little doubt that the robust construction should afford reliability in service.



Rig test at Sir George Godfrey and Partners of the cabin pressure delivery system for the Brabazon I.

CIVIL AVIATION NEWS

Aer Lingus Economy : Corporations' Statistics for Twelve Months

TASK COMPLETE : The last three B.S.A.A. Tudor IIs employed on the Berlin Air Lift photographed at London Airport on arrival from Germany. They have flown 2,619 sorties into Berlin since starting last Christmas.

CIVIL AIR LIFT FINISHES

WHEN the civil-aircraft section of the Berlin Air Lift finished last Monday, a total of approximately 144,500 tons of food, fuel and other essentials had been flown into the city by the British civil machines.

The latest figures available show that, up to August 10th, the civil Air Lift had made 21,785 flights to Berlin and had delivered 54,325 tons of food and other "day" supplies, and 87,474 tons of liquid fuel. The number of sorties flown by the various charter companies taking part were: Flight Refuelling, 4,441; Lancashire Aircraft Corporation, 2,760; Skyways, 2,730; B.S.A.A., 2,619; Bonds Aviation, 2,496; Eagle Aviation, 1,023; Airflight, 977; British American Air Services, 661; Westminster Airways, 544; World Air Freight, 507; Scottish Aviation, 381; Aquila Airways, 266; Silver City, 213; Transworld Charter, 118; Airwork, 74; Skyflight, 40; and early Dakota operators, 1,988.

AER LINGUS REPORT

FOR the year ended March 31st, 1949, Aer Lingus operated at a loss of £162,850. Last year the company showed a loss of £612,432 and the reduction of £450,000 is accounted for by a cut of £200,000 in operating expenses and an increase of £250,000 in revenue. The number of passengers carried increased by ten per cent from 152,633 to 167,349 and the gross revenue increased from £828,778 to £1,078,154. During the year three additional DC-3s were bought—to bring the fleet up to 13 after the Vikings had been sold—and all were converted from 21- to 26-seaters, thus affording a 25 per cent increase in carrying capacity. Fares were increased in an effort to meet the higher costs of operation but were subsequently decreased when it became apparent that the increase was adversely affecting demand. On April 1st, 1948, staff numbered 1,545, but by March 31st, 1949, the number had been reduced to 1,323.

A feature of the company's operations is the very high proportion of total revenue derived from passenger traffic. Although the volume of freight and mail carried has increased, it still represents only a very small proportion of the total revenue; in fact, the figure for air mail last year was less than one per cent of the total. The company maintained an overall regularity factor of 98 per cent and the entire fleet flew 2,564,792 miles during the year.

OPERATIONAL RESEARCH

DURING this month some 20 men and women from the M.C.A. Operational Research Section are engaged in a study of aircraft and passenger activity at London and Northolt Airports. Working in co-operation with airline operators and airport officials, they are analysing traffic primarily to assist future planning. The team hopes to determine whether there is any unnecessary and avoidable delay in the flow of aircraft, passengers and passengers' baggage and, if so, how much and for what reason. An attempt will also be made to assess the traffic capacity for both airports for the summer of 1950.

The Ministry's Airport Utilization Committee, on which airline operators are represented, is responsible for making plans about six months ahead for the movements of aircraft at London and Northolt, and scientific surveys of this type are made every six months to help that committee in its work. It is understood, however, that the present survey is the most thorough which has ever been made. As a result of analyses the operators will, it is hoped, be assisted in so arranging timetables that, as far as possible, the Airports will not be periodically overloaded and that delays may be cut to a minimum. Runways, control towers, communications, radar and such aspects as the availability of petrol bowsers and lorries and the utilization of the concrete apron will all come under review in a variety of operating conditions.

AGREEMENT WITH CEYLON

THE British and Ceylon Governments signed an air transport agreement on August 5th. It provides for the operation, by an airline nominated by Ceylon, of services between Ceylon and London, Ceylon and Singapore, and Ceylon and Sydney. A nominated United Kingdom airline will be permitted to fly services between Great Britain and Colombo, Singapore and Colombo and between Great Britain and Sydney through Ceylon.

AIRPORT OBSTRUCTIONS

REPRESENTATIVES of local authorities and other bodies interested in property surrounding London Airport met M.C.A. officials on August 10th to discuss the proposed Order which will permit the Minister to demolish buildings adjacent to the Airport. The primary object of the Order was to limit the height of structures in the immediate approaches to the runways at London Airport, but local residents were alarmed at the apparently wide powers which the Minister intended to secure.

At the discussion M.C.A. officials explained that there had been no intention to exercise the Minister's powers on a wide scale, particularly in cases where agreement could be reached with the owners of premises the present height of which would constitute a danger. The Ministry made it clear that there now appeared to be good hope of reaching voluntary agreement with the owners concerned and undertook that if agreements were concluded any new Order would be confined to the power to lop trees in certain limited areas. In the unlikely event of agreement not being reached, then special powers would be sought to reduce the height of particular buildings. The representatives approved the course of action suggested and the M.C.A. agreed to withdraw the original proposal.

M.C.A. calculations for assessing the danger to aircraft caused by tall structures is based upon agreed international standards. Thus, the lowest acceptable obstruction-free approach and take-off angle—that is, the slope to the horizontal—has been laid down as 1 in 50. Such an angle of approach is, of course, flatter than that which any aircraft would normally follow, but is designed to give adequate clearance. At an airfield surrounded by flat country, as is London Airport, 30ft buildings (the height of a normal two-storeyed house) would be just below the safety line at a distance of 500 yd from the runway, whilst at about one

mile a building 100ft high would just be an obstruction. In plan, the safety area widens as the distance from the airfield increases.

In order to safeguard aircraft making circuits of an airfield, as, perhaps, in conditions of low cloud, it is internationally laid down that outside the vee-shaped areas already described and within a radius of 2½ miles from the centre of the airfield there shall be no structure higher than 15oft above the airfield level. At London Airport the runways end well short of the airport boundaries and no dwelling houses outside the boundaries are near enough to infringe the standard safety requirements. There are, however, one or two high factory premises which are likely to form an obstruction.

BREVITIES

DURING the Berlin Air Lift, from July 26th, 1948, American Overseas Air Lines flew 2,366 round trips between Frankfurt and Berlin, carrying 17,242 passengers and 11,356 tons of cargo and mail. Now that the Air Lift is reduced, A.O.A. will fly a passenger and freight service twice daily.

* * *

A zone of Mediterranean commercial flying over which Air France has a monopoly is that between Metropolitan France and the French North African dependencies of Algiers, Tunisia and Morocco. This year 1,400 seats are being offered weekly on the Algiers route, against 730 in 1947; 365 against 210 in the case of Oran; 160 against 35 to Bone; 825 against 330 to Casablanca; and 556 against 100 to Tunis. On all these routes the company is obtaining a high load-factor

Traffic figures for the April-June, 1949, quarter on the B.O.A.C. New York to London route were: Passengers carried, 1,929; mail, 48,052 lb; cargo, 94,237 lb; average load per flight, 10,705 lb. This shows an increase of 1¾ tons per service compared with the same period last year. The increase was achieved with 53 flights compared with 75.

* * *

Morton Air Services, Ltd., of Croydon, have applied to the Air Transport Advisory Council for permission to operate regular services from Bristol to Guernsey, Jersey and the Isle of Man. The company is opening an office at Whitchurch on August 22nd, after which a full charter service for short or long hauls will be available from Bristol. Every encouragement

(*Continued on page 202*)

British Airways Statistics for the Year Ended March, 1949

(*Figures for the year ended March 1948 are given in parenthesis*).

	B.E.A. All Divisions	B.E.A. Continental Division	B.E.A. British Division	B.O.A.C. All Divisions	B.O.A.C. Western Division	B.O.A.C. Eastern Division	B.S.A.A
Passengers carried	589,471 (520,995)	207,436 (152,069)	382,035 (368,926)	127,914 (108,810)	37,513 (30,852)	90,401 (77,958)	21,513 (14,307)
Cargo carried ; Mail (tons)...	2,663.2 (1,390.9)	1,488.1 (599.3)	1,175.1 (791.6)	1,718.4 (1,692.3)	335.1 (287.3)	1,383.3 (1,405.0)	206.3 (170.1)
Freight (tons)	4,800.2 (3,022.7)	3,584.6 (2,034.4)	1,215.6 (988.3)	3,253.3 (2,087.4)	563.0 (315.3)	2,690.3 (1,772.1)	594.5 (553.4)
Average load; Passengers (No.)	13.1 (10.3)	14.7 (15.2)	11.1 (7.0)	15.6 (12.5)	25.6 (24.3)	14.1 (10.8)	9.7 (10.6)
Total (lb)	2,885 (2,211)	3,405 (3,420)	2,126 (1,302)	4,660 (3,879)	6,332 (6,396)	4,396 (3,542)	3,753 (4,113)
Average capacity; Seats (No.)	20.1 (14.8)	22.2 (20.3)	17.4 (11.1)	23.5 (18.7)	42.1 (42.0)	20.8 (15.5)	19.3 (19.5)
Total (lb)	4,603 (3,547)	5,223 (5,007)	3,698 (2,449)	7,508 (5,852)	10,771 (11,193)	6,993 (5,137)	7,248 (6,985)
Average length of haul (miles); Passenger	269 (239)	473 (484)	155 (138)	3,012 (2,935)	2,276 (2,423)	3,297 (3,140)	2,283 (3,634)
Mail	433 (411)	649 (783)	161 (131)	4,595 (4,247)	3,497 (3,444)	4,861 (4,411)	5,258 (5,689)
Freight	486 (516)	589 (693)	182 (150)	3,468 (3,362)	2,998 (3,054)	3,566 (3,417)	4,535 (5,643)
Hours flown; Revenue; Passenger services ...	84,381 (92,831)	40,028 (29,528)	44 353 (63,303)	126,655 (130,504)	12,841 (12,967)	113,814 (117,537)	23,963 (23,438)
Cargo services ...	6,166 (3,611)	6,166 (3,611)	— —	12,036 (2,908)	2,680 —	9,356 (2,908)	1,040 (383)
Charter and special flights	887 (984)	30 (270)	857 (714)	5,334 (6,394)	16 (287)	5,318 (6,107)	2,154 (56)
Non revenue	2,651 (3,378)	1,362 (1,262)	1,289 (2,116)	16,547 (21,962)	5,646 (7,845)	10,901 (14,117)	3,087 (1,474)
Equivalent annual utilization (revenue hours flown) per aircraft	1,224 (1,152)	1,342 (1,164)	1,125 (1,146)	1,284 (1,324)	— —	— —	1,365 (1,393)
Unduplicated route miles in operation at end of period	11,885 (13,044)	9,498 (9,255)	2,387 (3,789)	60,955 (58,318)	6,916 (8,523)	54,039 (49,795)	12,926 (18,375)
Percentage regularity	94.6 (95.5)	92.5 (96.9)	95.4 (95.2)	98.9 (98.7)	96.7 (96.5)	99.2 (98.9)	96.7 (96.9)
Average length of stage flights (miles)	185 (145)	392 (378)	110 (103)	981 (865)	1,104 (1,176)	964 (836)	990 (1,234)

IN *Flight* of August 11th, brief mention was made of the Corporations' statistics for the year April, 1948, to March, 1949. Further provisional details appear in the table above. All three Corporations have extended their freighter services; in the case of B.E.A. 956,080 revenue aircraft miles were flown, against 557,013 the previous year. In B.O.A.C. the increase was from 615,581 to 2,523,418, and B.S.A.A. freighter aircraft miles rose from 82,829 to 218,180. On the other hand, charter and special operations fell in B.E.A. from 111,263 to 87,810 aircraft miles flown; in B.O.A.C. they decreased from 1,013,024 to 732,662 aircraft miles. B.S.A.A. charter and special flights rose from 11,472 to 376,084 aircraft miles mainly on account of activity in the Berlin Air Lift.

Although the number of passengers carried in B.E.A. was greater than that in B.O.A.C., the latter Corporation flew 362,733,953 revenue passenger-miles compared with 155,027,743 in B.E.A. The B.O.A.C. figure showed an increase of 22.2 per cent, and B.E.A. an increase of 26.6 per cent over the previous year. The available seat-miles flown in B.E.A. increased from 176,718,077 to 237,770,934, and the load-factor dropped to 65.2 per cent from 69.3 per cent last year. In B.O.A.C. the available seat-miles flown increased from 445,534,216 to 546,991,463, which resulted in a slightly decreased load-factor of 66.3 per cent compared with 66.6 per cent in the previous year.

The overall load-factor improved in the B.E.A. British Division from 53.2 per cent to 57.5 per cent, and in the B.O.A.C. Eastern Division from 57.1 per cent to 58.8 per cent. It is interesting that the B.E.A. Continental Division revenue passenger load-factor fell from 74.6 per cent to 66.2 per cent, and the revenue overall load-factor fell from 63.3 per cent to 65.2 per cent.

Civil Aviation News . . . . .

is being given by the City's Airport Committee, since it has been the subject of local concern that no scheduled services operate into Bristol.

* * *

In addition to the three airports—Northolt, Renfrew and Ringway—mentioned in *Flight*, August 4th, B.E.A. catering branch has obtained a three-year M.C.A. contract for catering in the passenger buffets at Aberdeen, Inverness and Kirkwall.

* * *

As a result of the dollar shortage, Qantas Empire Airways have been instructed by the Australian Government to cancel the order, placed last June, for a fifth Lockheed Constellation. It is understood that Lockheeds have suggested a postponement of three months in the hope that a solution may be found. The current price of a Constellation is about £275,000.

Dublin Airport handled 1,580 Aer Lingus passengers on Saturday, July 30th, as against last year's record of 1,340 in one day. During the week ended August 3rd, 9,074 passengers passed through the airport, representing a 30 per cent increase over the number carried in the same week last year, which had stood as the previous record. During the month of July 29,305 passengers were carried on 1,400 regular and 122 extra services.

* * *

B.E.A. services to Orkney and the Shetlands will be continued throughout the winter with Dakotas, and after October a stop will be made at Aberdeen, so reopening the Glasgow-Aberdeen direct service. More adequate services will also be flown to Inverness. Bookings for the Edinburgh Festival are higher this year than they were last year and the load factor on the Edinburgh route is now better than on that to Glasgow. B.E.A. is providing a few extra seats to Edinburgh by flying passengers through Glasgow.

FROM THE CLUBS

FILMS of activity at the London Transport (Central Buses) Sports Association Flying Club are being made by B.B.C. Television Newsreel and by Pathé Gazette, and it is hoped that their ultimate showing will assist in giving the general public a clearer appreciation of the flying-club movement. In July the London Transport Executive Junior Staff Club, comprising apprentices and junior staff from the London Transport Area, were entertained and given flights by the Club at Fairoaks. Several other similar excursions have been arranged with the idea of introducing juniors to the Club and so making them air-minded. Membership is steadily increasing and organized parties from different garages are frequent visitors to Fairoaks.

* * *

BY logging nearly 432 hours during July, Herts and Essex Aero Club came near to equalling their record monthly figure of July, 1947. As in many other clubs, there has been a noticeable increase in mid-week flying, due mainly to holidays and the weather.

Two Broxbourne pupils are pursuing their flying training from the *ab initio* stage right through to that of obtaining their Commercial Pilot's Licences; one is an Indian visiting this country specifically for the purpose and the other is a private owner who intends to make civil aviation his career.

Another club member, an architect, who has been flying as passenger to various parts of England has found this means of transport so beneficial to his business that he has now learned to fly and has recently been passed solo. Several new Private Pilot's Licences have been issued and the Club intends to celebrate its M.C.A. approval with a party some time in September.

Discipline in the Herts and Essex Club is strict, and one recent case of reported low flying has resulted in a member's suspension.

* * *

DURING the week-end August 27th-28th the chairman of the Association of British Aero Clubs and Centres, Mr. G. H. M. ("Eustace") Miles, is making a tour of flying clubs, accompanied by the Parliamentary Under-Secretary of State for Air, Mr. Geoffrey de Freitas, and several officials from the Air Ministry and the Ministry of Civil Aviation. Mr. George Lindgren will join the party the second day. A precise itinerary has not yet been decided upon, but it is hoped that during the two days some 18 clubs will be visited; the night will probably be spent at Blackpool. Apart from stops for luncheon and tea, the party will spend about half an hour at each club, thus gaining an opportunity of seeing a representative cross-section of the club movement and thereby forming an appreciation of the present position, with all its difficulties, and of the potentialities for the future. The party will fly in a Dakota which has been put at the disposal of the A.B.A.C. by Kearsley Airways, Ltd.

* * *

IN spite of bad weather, the South Coast Flying Club held its landing competition on Sunday evening, August 7th. Mr. D. Monro won by landing his Fairchild Argus one yard from the mark, while Mr. A. G. Head, flying a club Auster, was a close second at two yards. Mr. D. Parry, in one of the Club's Tiger Moths, was third only four yards from the mark.

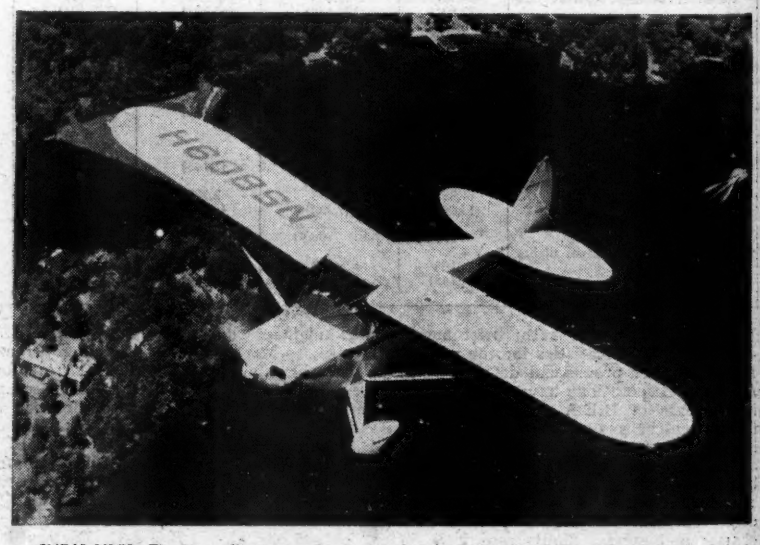
* * *

AS mentioned in *Flight* of July 14th, Thruxton Air Races will be held on Sunday, August 21st, starting at 2 p.m. Closed-circuit pylon races will start at 2, 3, 4 and 5 p.m., and there will be a high-speed handicap race from Thruxton to Totland Bay and back, a distance of some 72 miles. During the afternoon there will also be aerobatics by R.A.F. Spitfires and Vampires and an Olympia glider. Spectators will have the opportunity of competing in height- and speed-judging contests. Special bus services are being run between Salisbury and the airfield.

* * *

FURTHER details are now available of the Ladybird ground trainer mentioned in *Flight* of August 4th. The prototype machine has been constructed as a shoulder-wing monoplane with no fixed surfaces and having no inherent stability, the whole being supported on a pivoted undercarriage which can be locked for early-stage, tail-up, straight take-off and landing simulation.

The machine has been built in wood, is covered with fabric and is powered by a Sprite engine. Subsequent machines will, however, be constructed of welded-steel tube covered with Alclad and be powered by 1,000 c.c. Indian engines, suitably converted. It is understood from Mr. D. E. Bianchi that the machine will be placed on the market only if it can be sold for £100 maximum. It will be remembered that this trainer is intended for training pupils in the early stages in the operation and response of controls, and in general handling.



CHEAP PIPER: The Piper Clipper is a four-passenger aircraft with a 115 h.p. Lycoming engine. A cruising speed of 112 m.p.h. and a top speed of 125 m.p.h. are claimed, and with a fuel capacity of 30 gall, the range is 480 miles. The fuselage is a steel structure and the wing is a fabric-covered light-alloy assembly. Claimed to be the world's cheapest four-seater, the Piper Clipper costs 2,995 dollars (approx. £750).

The National Gliding Contests

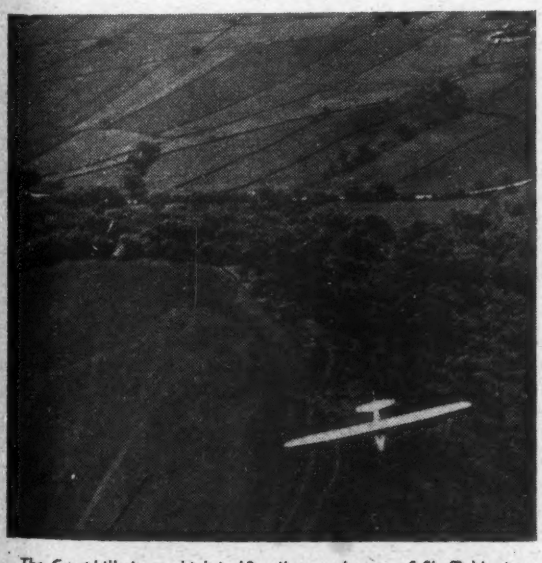
Next Week's "Classic" in Derbyshire: Rules, Personalities, Sailplanes and Possibilities.

NEXT week-end sees the commencement of the principal event in the British gliding calendar—the National Contests organized by The British Gliding Association. The competition—the eleventh of the series—will be held at Camphill, near Hucklow, Derbyshire, at the site of the Derbyshire and Lancashire Gliding Club, from August 21st to 28th inclusive.

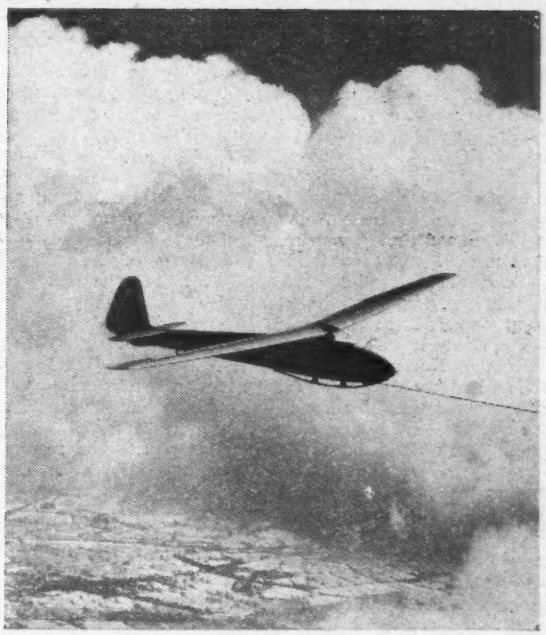
The site is by no means untried as far as competitive high-performance soaring is concerned: the National Contests were held there in 1939, and, earlier, in 1937 and 1936. The annual contest took place regularly at various sites from 1930 until 1939. In 1933, at Huish, the late G. E. Collins, flying a B.A.C. VII two-seater, was the first to use the thermal soaring technique. The following year, at Sutton Bank in Yorkshire, flights of "Silver C" merit were achieved for the first time, and an altitude record of over 8,000ft established by G. M. Buxton in a thunderstorm, remained unbeaten for several years. The year 1937 was an outstanding one: a more competitive system of awarding points was introduced, encouraging the more ambitious pilots. As a result, 43 cross-country flights were made during the week to a total of 1,489 miles, and several pilots reached their declared goals.

The last two meetings before the war, held respectively at the London Gliding Club, Dunstable, and at Camphill, maintained the high standard of performance set in 1937, and were marked by the keen rivalry between P. A. Wills in his Minimoa sailplane and a Rhönsperber team led by the late C. Nicholson, which in both cases won by a narrow margin.

In 1947 the Contests were resumed; this time a flat site was chosen—the Royal Naval Station at Bramcote, in the Midlands. Launching was almost entirely by aero-tow, a method which had first been made available at the 1938 Dunstable meeting. In the absence of a hill along the upwind side of which they might soar whilst waiting for an opportunity to get away, the competitors were towed to a good height, but had only a few minutes in which to find a thermal before being forced to land and try again.



The Camphill site—which is 12 miles south-west of Sheffield—has a variety of slopes: this is one of the few wooded approaches. The public will be admitted at a fee of 1s. (car parking, 2s. 6d.)



Fourteen of the thirty competing sailplanes will be Olympias built by Elliots of Newbury. The remainder are of eight other types.

Well organized by the B.G.A., with the efficient help of the Navy, the 1947 meeting was very successful. Some 2,200 miles of cross-country flying were done in a single day of soarable westerly weather, when several pilots reached the east coast. P. A. Wills, enriched by his flying experience with the A.T.A., retained throughout the meeting the lead which he had won on the first day with a remarkable goal flight to Dunstable made almost entirely in cloud and at heights varying between 6,000 and 9,000 feet. He was flying a reconditioned German Weihe. Nicholson was second in a two-seater Kranich entered by the Royal Navy.

Turning for a moment to international gliding, it may be remarked that it was intended to include soaring in the programme of the 1940 Olympic Games, and preparations had gone as far as the competitive selection of a one-design machine for it. In 1948, however, Olympic gliding was not considered practicable.

It was decided instead to hold an International Competition under F.A.I. rules at Samedan, in Switzerland. Some remarkable soaring flights were achieved on that occasion, pilots being constantly above 12,000ft and often flying blind in turbulent and freezing conditions. Another international meeting will be held next year in Sweden, and at the forthcoming Camphill meeting selectors will be watching the form of our outstanding performers with a view to choosing a British team for Sweden.

The Derby and Lancs site has the advantage of having several soaring slopes facing winds coming from different directions. Thus it will be possible for competitors to remain airborne in hill lift under a variety of weather conditions prior to getting away either by thermal or standing-wave soaring.

Club officials have drawn on the experience acquired in the running of past National contests to ensure efficient organization of the coming one. Every morning at 0945 the pilots will be briefed in meteorological flying control and any other relevant matters. It will then be up to them to use their judgment to decide at what approximate time they wish to be launched; if his first launch is not successful each competitor will have to wait for his turn before he can try again. Launching will be by motor

The National Gliding Contests . . .

winch or by elastic catapult. There will be no aero-tow launches or retrieving. Launching procedure is as follows: the machine is towed to the starting point and, everything being ready, the pilot enters his number on the starting board, below those which are already up, and he is launched when his turn comes. Should he, before then, decide that the move is premature, he can scratch and go to the end of the list, or even wait a while before entering again. Good timing may make all the difference between a successful flight or failure to leave the site. Thus judicious co-ordination of teamwork to get the machine to the line, together with competence in weather assessment, is needed in addition to piloting skill.

The Contests are open to pilots normally resident in Great Britain or Northern Ireland or who are serving members of His Majesty's Forces. Whilst foreign entries cannot be accepted for these National Contests, foreign visitors and their aircraft will be welcomed and given facilities for flying when this can be done without prejudice to the competitors. A pilot from the Argentine is among the foreign visitors expected to fly.

Actually, it is the gliders that are entered for the competition and marks are awarded to them and not to the pilots. With each entry there is a team of two to four people, all or any of whom may be pilots.

NUMBERS, COMPETITORS AND GLIDERS

1. D.G.O. Hiscox (Olympia EoN).
2. Bristol Gliding Club—K.W. Turner, C. Staffurth (Olympia EoN).
3. J. Hurry, N. P. Anson, J. Buckley (Olympia EoN).
4. P. J. Cooper, A. A. J. Sanders, A. H. Yates (Olympia EoN).
5. J. S. Armstrong, L. R. Robertson, E. H. Taylor, L. R. Bulling (Olympia EoN).
6. T. Rex Young, A. N. Other (Olympia EoN).
7. G. H. Lee, C. J. Arnold (Slingsby Gull I).
8. Prince Birabongse (Weihe).
9. P. A. Wills (Weihe).
10. E. Swale, T. Dolan, Margaret Swale (Olympia EoN)
11. Empire Test Pilots School—Lt.-Cdr. P. S. Wilson, R.N. (Olympia EoN).
12. C. J. Wingfield, D. Ince (Olympia EoN).
14. D. A. Smith (Olympia EoN).
15. A. H. Warminger, J. C. Ward, P. O. Gould (Olympia EoN).
16. Surrey Gliding Club—J. C. Neilan, W. A. H. Kahn, D. Reid, D. Brown (Weihe).
17. Imperial College Gliding Club—R. A. B. Macfie, P. Murden, R. Nurney, F. G. Irving (Olympia EoN).
18. Surrey Gliding Club—J. A. Sowrey, G.R.E.C. Gregory, C. W. Dowdall, W. F. Jordan (Olympia EoN).
19. London Gliding Club—P. A. Lang, J. R. Court, H. G. Wheatcroft (Kirby Prefect 30B).
20. London Gliding Club—C. A. P. Ellis, L. Wright, A. E. Rowley (Kirby Gull IV).
21. 12 Group Gliding Club—W/C. A. J. M Smyth, F/O. F. Hutchinson, Plt. Il Cempel, F/O. T. P. D. La Touche (King Kite).
22. B.A.F.O. Gliding Club—F/L. P. G. Mallett, F/L. C. T. Lynas (Weihe).
23. B.A.F.O. Gliding Club—F/L. R. C. Forbes, S/L. A. A. Binks (Weihe).
24. Association of B.A.F.O. Gliding Clubs—G/C. W. B. Murray, Sgt. D. Campion (Weihe).
25. G/C. G. J. C. Paul, J. W. Leach (Kirby Kite II).
26. Cambridge University Gliding Club—P. H. Blanchard, J. Free, T. G. Phillips, F. R. Ward (Olympia EoN).
27. Cambridge Universty Gliding Club—J. W. S. Pringle, J. Grantham, D. L Martlew, A. L. L. Alexander (Kranich).
28. Dr. A. Derkedder, S. C. O'Grady, A. C. Burmingham (Petrel).
29. Derbyshire and Lancashire Gliding Club—R. D. Roper, H. U. Midwood (Gull I).
30. R. D. Dickson, G. Thompson, P. W. Leech (Viking).

Marks will be awarded to each glider for the best flight it makes during the day. For a distance flight in excess of 12 miles, 2 marks per mile will be earned for the first 50 miles, 3 marks per mile for the next 50, and 5 for any further distance. A bonus of 20 per cent of distance marks earned will be given for flights ending within 1,000 yards of a destination declared in writing before the flight. Marks will also be awarded for gains in height in excess of 1,500ft: 1 mark per 100ft up to 4,000ft, 2 marks per 100ft for the next 4,000ft, and 5 marks per 100ft for any further height climbed.

In addition to this marking for distance and height, a premium for speed will be introduced if and when the weather is suitable. A new feature of our National Gliding Contests, it will take the form of timed goal flights and closed-circuit races.

The winning aircraft in the whole Contest will be the glider which amasses the greatest number of marks. Weather that is consistently good for soaring will mean soaring by day and retrieving by night and, as the teams are responsible for their own retrieving, team-work will

Philip Wills may be relied upon to put up an outstanding performance: he is seen here with Mr. F. N. Slingsby, constructor of the Gull and other famous types, but will fly a Weihe in the Contests.

then become very important and may decide the issue. (The B.A.F.O. teams, incidentally, have two-way radio-telephonic communication between the retrieving cars and the sailplanes in flight and after landing.) In addition to the prizes for the first glider and those placed, there are numerous trophies, awards and daily prizes.

The list of entries, which was closed on July 16th, is given on this page. Some last-moment scratchings are, of course, possible; already it is reported that "Bira" has smashed his Weihe and that G/C. Paul will not be able to attend.

Who will challenge the supremacy of Philip Wills this year now that Nicholson is gone? Handicapped at first by a skiing accident, Wills has done relatively little flying this year, though of a very high quality indeed, well planned and well executed; he has extended his own British distance record. There is no doubt that the Weihe is the most efficient machine in the contests. The Surrey Gliding Club has flown very well this year (their members have done over 2,000 miles cross-country to date), and they have instrumented and tuned their red Weihe to a very fine pitch. There is also the challenge from B.A.F.O., with three good Weihe aircraft and several excellent Service pilots—who, however, are more at home in the more "contrasty" soaring conditions of the Continent.

One must not forget, however, that within the 15-m span class the Olympia, though necessarily less efficient than the wider Weihe, will be credited with a bonus of 10 per cent of all marks gained, and that it is a first-class all-rounder of very helpful stability; indeed, it was the design chosen for the 1940 Olympics. It is now more than two years since our pilots, thirsting for good sailplanes in which to do their post-war soaring, were able to buy British-built EoN Olympias. Some of them, like Charles Wingfield, have put in many a good hour's soaring in Olympias and know how to get the best out of them. One can only regret that Stevenson, still the only man to have crossed the Channel by fair soaring (and whose handling of his Olympia is quietly impressive) will not be able to compete.

Of the same dimensions as the Olympia, and claimed to be somewhat superior to it in performance, a Gull IV—designed and built since the war by Slingsby Sailplanes, of Kirbymoorside—will be entered by a team from the London Gliding Club. Its progress will be followed with interest, but one would have liked to see more of its kind entered for a fair comparison to become possible. Two models of its pre-war ancestor, the Gull I, have also been entered: one of them is the same blue sailplane with which Stevenson crossed the Channel in 1938.

J. C.

Prestwick Pioneer Progresses

Advances in Power, Load and Performance of the Scottish Specialist Type

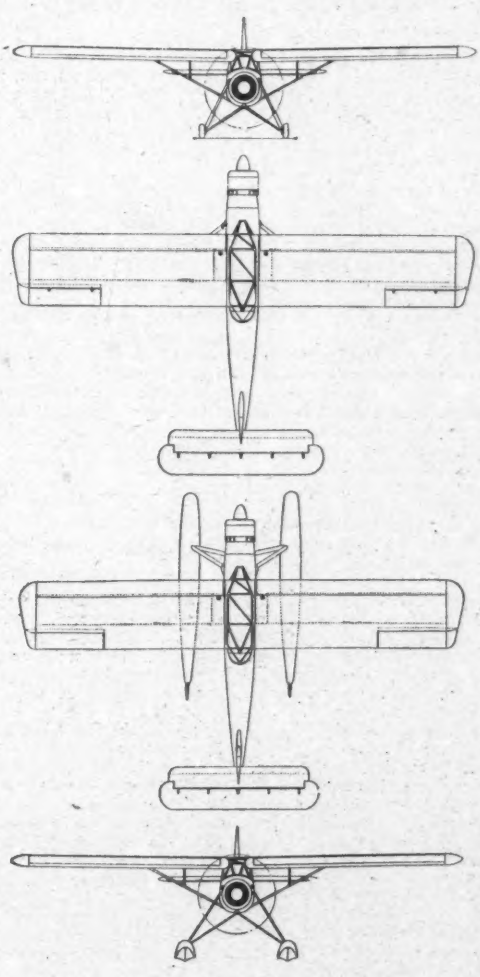
The exceptional take-off and landing characteristics of the Pioneer are largely responsible for its distinctive appearance.

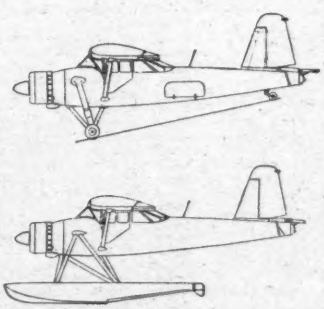
WHEN Scottish Aviation, Ltd., produced the first Prestwick Pioneer (*Flight*, October 2nd, 1947) it aroused a considerable measure of interest as a result of its extraordinary performance.

Originally powered with a de Havilland Gipsy Queen 30 Series engine of 240 h.p.—and so designated Mk 1—the Pioneer has now been modified and equipped with an Alvis Leonides, in which guise it is designated Mk 2. Naturally enough, the Leonides' take-off rating of 520 b.h.p. has made a considerable difference to the aircraft's take-off performance and, more particularly, to the payload which can be carried. In that the gross weight has increased by 48½ per cent, however, the fact that the payload has increased by 56½ per cent means that the payload/gross weight ratio has altered very little—in point of fact, it is improved by 1 per cent. Alternative power units such as the Cheetah 25 and the Pratt and Whitney Wasp Junior are envisaged as being suitable for the Mk 2 Pioneer.

The inherent structual design of the aircraft remains unchanged in the latest version, although a few deviations from the original have been made. Span has been increased by the fitting of rounded wing tips, and this has incurred a concurrent increase in wing area. By the same token, the fact that the elevators have been furnished with horn balances at the tips has led to an increase in tail unit span. In the original aircraft, the tailplane incidence was adjustable by means of an electric screw-jack so that an angle could be selected to compensate the extreme nose-up attitude of the aircraft when flying at its ultra-low speed, and so obviate the onset of tailplane stall. This system of tail adjustment is still employed, but the range has been reduced from 14 to 9 deg. so giving movement from a positive incidence of +4 deg to a negative of −5 deg.

In view of the increase in all-up weight to 5,400 lb, the stalling speed has gone up to 37 m.p.h. T.A.S. (although





General arrangement of the landplane and floatplane versions. Data (given overleaf) are generally similar for both, although the gross weight of the floatplane is 50lb greater.

the large position error inevitable at so low a speed gives an I.A.S. of 22 m.p.h.). Some emphasis is given to the low-speed capabilities of the Pioneer by the fact that the Boscombe Down trials showed that it had a rolling distance after touch-down of only 20 yd at full load and in no wind—this despite the fact that the subsidiary split flaps on the large-chord Fowler flaps have been deleted. Slight alterations have also been made to the undercarriage in that the 20.6 × 7.4 in tyres fitted on the Mk 1 have been changed for 24 × 7.65 in tyres on the Mk 2. At the same time, in fitting larger wheels the opportunity has been taken to substitute larger brakes—alhough still of single-disc type—the energy absorption capacity having gone up from 180,000ft/lb to 400,000ft/lb.

As may be seen from the G.A. drawings, the Pioneer is available as a floatplane, and if required for ambulance use, can be fitted with a special door to facilitate loading and unloading a stretcher. Scottish Aviation state that the Pioneer has elicited a number of enquiries, particularly from abroad, and they have every reason to hope that the Ministry development contract they have received for one Mk 2 (with the possibility of a further two aircraft if flight trials prove satisfactory) might be followed by firm orders for others.

PRESTWICK PIONEER MK 2
(One 520 b.h.p. Alvis Leonides)

Span	52ft 9in
Length	34ft 7in
Height	10ft 1in
Wing area	411 sq ft
Tailplane span	18ft 8in
Empty weight	3,875 lb
Gross weight	5,400 lb
Gross weight, floatplane version	5,450 lb
Payload	1,065 lb

Performance

Cruising speed	160 m.p.h. at 10,000ft
Initial climb	1,020ft/min
Service ceiling	23,000ft
Take-off to 50ft	185yd
Landing from 50ft	130yd

Range : 490 miles at 120 m.p.h. at 5,000ft with 1,065 lb load + 57 Imp. gall. fuel.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

DOUBLE DECKERS

A Final Claim ?—the Junkers G.38

I SHOULD like to thank Mr. Christopher Blackburn (July 28th) for correcting me in regard to the Dornier Do.X as having three decks instead of two. On checking through my data files on the world's transport aircraft, I find that we have all apparently overlooked the highly unorthodox big Junkers type G.38 transport of the 1934-37 era, *when it was in regular service* on several of Deutsch Luft Hansa's European routes.

Having a loaded weight of 52,900 lb, it carried 34 passengers plus a crew of seven. There were two small cabins each seating three passengers in the leading edge of its huge wings, a cabin for two situated in the nose (affectionately dubbed, I believe, the honeymoon suite!), whilst the balance of 26 persons were seated in two large cabins *located on the upper and lower decks.*

Needless to say, the crew compartment was on the upper deck of this aircraft, with a baggage and mail compartment on the lower. Having a cruising speed of 129 m.p.h., this type was undoubtedly a bold and courageous experiment in airliner design some 15 years ago. I think I am also correct in stating that a small number of this type were still flying in 1939, and were actually pressed into service in the Luftwaffe during the air invasion of Denmark and Norway.

Prestwick, Ayrshire. DENNIS M. POWELL.

THE RIGHT SORT OF EDUCATION

A Schoolmaster's Enthusiasm

AS a regular reader of your excellent journal and an enthusiastic follower of the progress of aviation generally, I feel that you may be interested to learn that nine boys, eight of them pupils of this school (Colmers Farm Secondary Modern School, Rubery, nr. Birmingham), are shortly undertaking a tour of Holland with me. We are travelling by air, using the K.L.108 service from London Airport at 1600 hr on August 10th.

The boys all wished to fly when given the chance of choosing the method of travel. Their parents are all agreeable to this and are, actually, enthusiatic. I think this is in no small measure due to the fact that this school has come to be known locally as "The airborne school"! This has arisen because of the fact that, during the summer of 1947, no fewer than 70 of the children had 30-min flights from Birmingham (Elmdon) Airport by Patrick Aviation, Ltd. Three of my present party of boys have already been airborne in this way and consequently feel that 1¼ hr in a Convair 240 is "just the job."

We had originally intended and hoped to be able to use Birmingham Airport as K.L.M. were to have operated a service from there to Schipol. I am informed that this fell through owing to "difficulties with the British Authorities."

Rubery, Nr. Birmingham. C. E. MITCHELL.

AUSTERITY AIR TRAVEL

Why Seek the Lowest Common Denominator ?

YOUR correspondent, Mr. Thomas D. Keegan (August 11th), compares airline travel with bus and rail travel. Because one is pushed around in surface travel, why should airlines follow suit?

It is no idle boast that "B.O.A.C. takes good care of you." Overseas air travel is not expensive compared with travel by ship or train in some parts. People living in Uganda and Rhodesia find it cheaper to fly to the U.K. than to make the long journey to the coast by train followed by the long sea journey. Passengers are full of praise for the care and attention given by all, from skipper to steward. The "gold-braided driver who saunters up and down chatting" does so for very good reasons. It is impossible from the flight deck to be able to say whether the temperature is right in the saloons, and a good skipper can make a big difference to the happiness of his passengers.

Your correspondent seems to have the outlook of the typical socialist who would like to bring the level of comfort down to train and bus standard. He would do better work if he would strive to raise the standard of bus and train travel to that of air travel. It will be a great step forward when "British Railways takes good care of you."

By the way, in my letter about Acton Aerodrome, published in the same issue, you have altered my spelling of Grahame-White, omitting the "e" of "Grahame." As I value my reputation for accuracy, I write this to point out that the error was not mine. There was a Liberal M.P. named Graham White who has often been confused with the pioneer aviator Claude Grahame-White.

London, S.W.3. GEOFFREY DORMAN.

[This was a printer's error which should, of course, have been noticed.—ED.]

FORTHCOMING EVENTS

Aug. 17th-27th.—Model Engineer Exhibition, New Horticultural Hall, London, S.W.1.
Aug. 20th.—South Hants Ultra Light Aero Club : Display, Christchurch.
Aug. 20th.—Singapore Air Day and Static Exhibition.
Aug 21st to 28th.—British Gliding Association : National Gliding Contests, Gt. Hucklow, Derbyshire.
Aug. 21st.—Wiltshire Flying Club and Royal Artillery Flying Club Thruxton Air races.
Aug. 28th.—Cowes Aero Club : Air Display.
Sept. 3rd.—Association of British Light Aero Club and Centres : Summer Conference, White Waltham.
Sept. 6th to 8th.—R.A.F. Golfing Society : Autumn Meeting and Ladies' Section Championship at Walton Heath Golf Club.
Sept. 7th to 11th.—S.B.A.C. Annual Flying Display and Exhibition, Farnborough.
Sept. 7th.—R.Ae.S. (Luton) : "Air Liner Operation."
Sept. 12th to 18th.—Battle of Britain Week. R.A.F. "At Home" day Sept. 17th.
Sept. 14th.—Inter-Services Swimming Championships, Seymour Hall, Marylebone, London.
Sept. 15th.—R.Ae.S. : Fifth British Commonwealth and Empire Lecture, "Inter-City Transport Development on the Commonwealth Routes," by E. H. Atkin, F.R.Ae.S.

PREVIEW: Members of London University Air Squadron had an illuminating glimpse of future equipment during their recent camp at North Weald, when John Derry, the de Havilland test pilot, demonstrated the capabilities of the D.H. Chipmunk. The new trainer is seen during the 15-minute display, which included slow rolls, loops, spins—and a bunt.

Royal Air Force and Naval Aviation News and Announcements

SERVICE AVIATION

Ulster Appointment

IT is announced that the Prime Minister of Northern Ireland, Sir Basil Brooke, has succeeded the late Lord Londonderry as Honorary Air Commodore of No. 502 (Ulster) Squadron, R.Aux.A.F., which is based at Aldergrove. Sir Basil also becomes Honorary Air Commodore of "502's" affiliated units, No. 2502 Light A.A. Squadron, R.Aux.A.F. Regiment, and No. 3502 Fighter Control Unit, R.Aux.A.F. From 1937 until it was disbanded after the war, No. 502 Squadron formed part of Coastal Command and was equipped with, successively, Ansons, Whitleys and Halifaxes. Like all auxiliary squadrons, however, it it now a fighter unit, and is equipped with Spitfires.

Goodwill Meteors

DRAWN from two squadrons of No. 11 Group, Fighter Command, eight Meteors were yesterday due to take off from their base at Duxford, near Cambridge, for a goodwill tour of Norway and Sweden as the guests of the two countries' air forces. W/C. H. M. Pinfold, the Commanding Officer of Duxford, is in charge of the detachment, which includes the two squadron commanders—S/L. A. G. Todd, D.F.C., of No. 66/111 Squadron, and S/L. P. H. G. Wintle, D.F.C., of No. 92 Squadron.

Ground crews were to travel in a Transport Command York, and two Dakotas were provided to carry spares and a mobile homing unit. First point on the route was at Eindhoven, where the Meteors were to refuel before flying on to Sylt for an overnight stay. They were due to reach Gothenburg, Sweden, to-day. From Gothenburg they will fly to Norrkoping, and thence to Stockholm, where they will remain over the week-end.

By next Tuesday the detachment should be at Oslo, arriving at Stavanger the following day. The return flight will be made from Stavanger *via* Gothenburg and Sylt, and the Meteors are due back at Duxford on August 25th Pilots will demonstrate the Meteor throughout the tour.

R.A.F. Rugby Chairman

IN succession to A. Cdre. G. R. Beamish, C.B., C.B.E., Commandant of the R.A.F. College, Cranwell, G/C. K. B. B. Cross, C.B.E., D.S.O., D.F.C., has been elected chairman of the R.A.F. Rugby Union. G/C. Cross, who was recently appointed to the command of R.A.F. Station Horsham St. Faith, has played rugby for the Harlequins, Eastern Counties and Sussex. He first played for the R.A.F. in 1934.

Commissions for National Servicemen

SEVENTY-TWO more commissions a year—in the Fighter Control Branch—are now available to men doing their National Service in the R.A.F. Already National Servicemen have the opportunities of commissioned service in the Equipment, Secretarial and Education branches and the R.A.F. Regiment, totalling 500 each year, and pilot training up to "wings" standard is also given to 300 selected National Servicemen each year.

Airmen on Horseback

TO encourage and raise the standard of horsemanship in the Royal Air Force, the R.A.F. Equitation Association has been formed. It will have its own stables and horses at Bomber Command H.Q., High Wycombe. The Association will endeavour to provide training facilities and mounts for the R.A.F. Modern Pentathlon representative team.

Developed from the Bomber Command Riding Club formed in 1948, the Association has as its president Air Marshal Sir Aubrey Ellwood, the A.O.C.-in-C. Bomber Command. Chairman of the executive committee is A.V-M. S. C. Strafford, the Command's S.A.S.O., and the honorary secretary is S/L. E. R. Parsons of Bomber Command H.Q.

All ranks of the R.A.F. in the United Kingdom are eligible for membership. For officers the annual subscription is £1 1s, and for airmen and airwomen 5s. Riding fees are at the rate of £1 8s a month for officers and £1 a month for airmen and airwomen, entitling members to 10 one-hourly periods of instruction and riding during the month. Alternatively, officers may pay for separate periods at the rate of 3s an hour and airmen and airwomen at the rate of 2s 6d an hour.

Display in Germany

NO. 2 Group, B.A.F.O., supported by Fighter and Transport Commands, staged an air demonstration at Gutersloh, Germany, last Tuesday (August 16th) for senior officers of the three Services. It is hoped to give a full account of the display in next week's *Flight*.

Naval Experiment

TEN volunteers from National Servicemen entering the Navy during the first three weeks of this month will be selected for aircrew training, as a trial scheme for supplementing the reserve pool of specialists in Naval Aviation.

Seven will undergo pilot training at R.A.F. Syerston, and three will do a nine-month course of observer training at the R.N. Air Signals School, Portsmouth, spending the remaining half of their full-time service on a carrier. After reaching "wings" standard, the seven pilot trainees will, it is expected, have only three weeks' service left. This period will also be spent on a carrier. After release, the ten will continue training with the R.N.V.R.

Battle of Britain Reunion

A BATTLE OF BRITAIN Reunion Dinner will be held at Fighter Command Headquarters, R.A.F. Bentley Priory, Stanmore, Middlesex, on Thursday, September 15th, 1949. Assembly will be at 7 p.m. for 7.30 and dress will be dark lounge suits.

All serving and released flying personnel who flew fighters in the Battle of Britain between July 10th, 1940, and October 31st, 1940, and who are eligible to wear the clasp of the 1939/45 Star, are invited to apply for tickets to the Senior Personnel Staff Officer, H.Q.

Service Aviation . . . . .

Fighter Command, R.A.F. Bentley Priory, Stanmore, Middlesex, not later than September 1st, 1949. Envelopes should be clearly marked "Battle of Britain Dinner." Accommodation will be limited but everything will be done to accommodate as many as possible of those eligible.

Recognition Aid

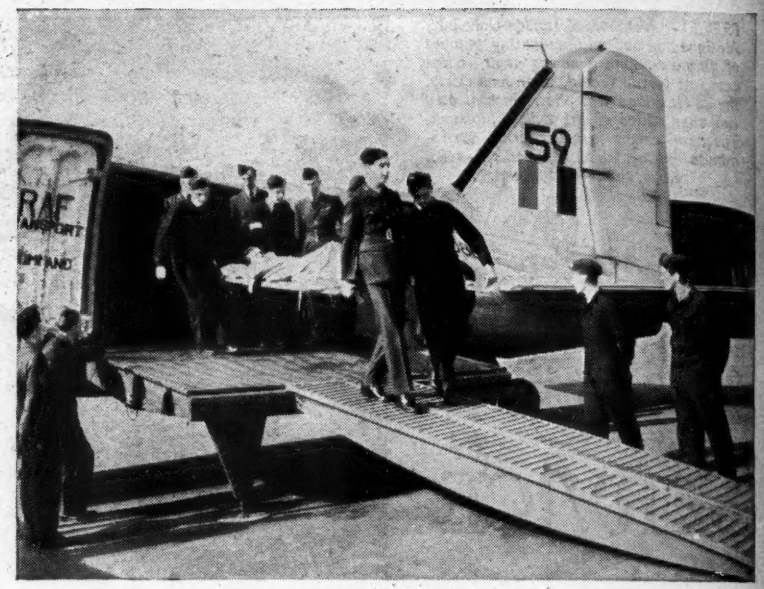
MEMBERS of the Air Training Corps are to have their own distinctive tie for civilian wear. The design—dark blue with the A.T.C. falcon in silver—has been approved by Air Marshal Sir Alan Lees, the A.O.C.-in-C. Reserve Command. Ties will be available within a few weeks, and will be supplied through A.T.C. squadrons only.

Durham Squadron's Camp

FOR what is considered to be their most successful summer camp to date, members of No. 607 (County of Durham) Squadron, R.Aux.A.F., recently spent a fortnight at Horsham St. Faith. The Squadron's Spitfires left their base at Ouston, near Newcastle-on-Tyne, on July 23rd and returned on August 6th after completing a total of 300 accident-free flying hours.

Training activities included air-to-air and air-to-ground firing, instrument-rating practice and tests (four members qualified for "green tickets"), interception exercises and formation practice. Weather was good and permitted the Squadron to fly daily from 0800hr to 1600hr, with the exception of a break for August Bank Holiday—described as "unwanted." The camp also had its recreational moments, consisting of sailing on the Norfolk Broads, swimming at the coast, visits to the local speedway and greyhound track, tennis, squash and golf.

On August 3rd the Squadron was inspected by the A.O.C.-in-C. Reserve Command, Air Marshal Sir Alan Lees, K.C.B., C.B.E., D.S.O., A.F.C. The Commanding Officer of No. 607 Squadron is S/L. J. R. Kayll, D.S.O., C.B.E., D.F.C., and the Flight Commander is F/L. J. M. Bazin, D.S.O., D.F.C.



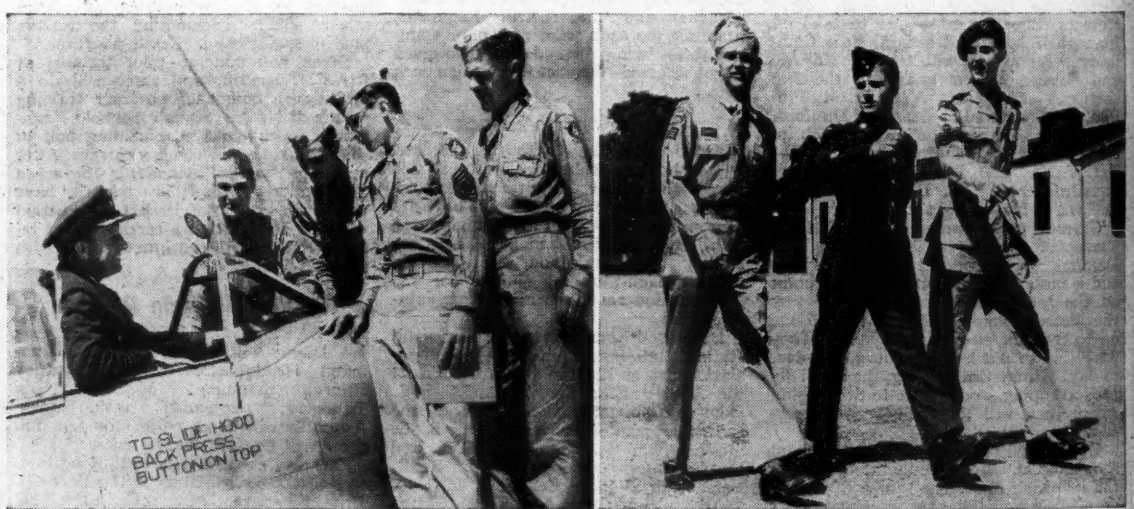
AIR AMBULANCE INAUGURATION: Every Tuesday and Thursday, a Dakota of No. 46 Group, Transport Command, leaves one of three airfields in N.W. Germany carrying up to 15 hospital cases from the British military and civil occupation forces and their families. The first patient to be landed at Lyneham, when the service began on August 9th, is seen above.

No. 43 Group Appointment

UNTIL recently Deputy Director of Technical Administration at the Air Ministry, G/C. H. H. Chapman has been appointed Senior Air Staff Officer, No. 43 (Maintenance) Group, with the acting rank of Air Commodore. A signals specialist, A/Cdre. Chapman was previously at the Air Ministry as Deputy Director of Technical Training (Signals) (a post he held for nearly two years from February, 1945), and was afterwards chief signals officer at H.Q., Air Command, Far East, for a year. On his return to England he took a course at the Joint Services' Staff College before being posted to the Air Ministry again last October. He held signals appointments at various group headquarters and at the Headquarters of the North African Air Force from 1941 to 1945.

Reunion

A REUNION for former members (all ranks) of No. 84 Squadron, R.A.F., will take place at the Duke of York's Headquarters, King's Road, Chelsea. Tickets (5s) may be obtained from O. Greenwood, 4 Kensington Court, London, W.8.



TRANSATLANTIC QUIZ: (Left) Cadets of the U.S. Civil Air Patrol, who arrived at Northolt under the exchange scheme on August 5th, make the acquaintance of G/C. E. M. Donaldson, Commander of the A.T.C., and his personal "Spit." Representatives of the three junior services involved in the exchange are the members of the American, Canadian and British cadet bodies seen (right) on the Uxbridge parade ground.

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